Electrical World

Published by McGraw Publishing Company, Inc.

The consolidation of Electrical World and Engineer and American Electrician.

Vol. 62 . NEW YORK, SATURDAY, DECEMBER 13, 1913 No. 24

Anti-Trust Legislation

The present unrest in business is plainly disconcerting to the administration at Washington. It is more disconcerting because of the disposition of the country to hold the party in power responsible for any reaction in business which follows tariff tinkering. President Wilson has an ambitious program of legislation and there are many about him to aid in promoting passage of the laws which they think the country needs. In the consideration of the pending currency measure there has been an evident disposition to disregard counsel from the bankers on the ground that they are too much concerned to give disinterested advice. It was not easy for bankers to get a hearing. The new Congress will have before it bills that are just as far-reaching in their effect on industries as currency legislation. Among the most important of these will be measures looking to the interpretation of the Sherman anti-trust law. It is expected that Mr. L. D. Brandeis and Mr. Samuel Untermyer will present their solutions of the problem and that the President's plan will be plainly earmarked so that the wishes of the administration may be clearly understood by all. It is equally important that industries affected by government legislation or agitation on this subject should have ample opportunity to present their views. It is a fundamental fact in our form of government that the governed have a voice here. In a matter so intimately affecting prosperity as will the proposed trust legislation the voice of all concerned should be sought and welcomed. The opinions of officials of manufacturing industries should be asked; but if they are not sought they should be advanced anyway through channels that are not closed to presentation of views on business when they come from the business men most vitally affected. The proponents of radical legislation will be on hand clamoring to be heard. The conservative business interests of the country should be equally insistent in favoring a course that will protect and promote legitimate industry.

Expansion in Exports

The returns of the Department of Commerce for September, 1913, bear evidence to the continued expansion in electrical export trade that is rather surprising for such a season of the year and at a time when business generally has been at a low ebb owing to tight money, political uncertainties, wars or rumors thereof, and the closing up of good markets, such as Mexico, by internal troubles. It appears that the total export of "electrical machinery," a grouping that includes a great deal of material for other articles than machinery—such as lamps and telephones—was no less than $2,254,254 for this September as compared with $1,852,400 in the same month of the previous year. This maintains previous gains, as the nine-month period in 1913 shows $21,203,489 as against $16,677,495 in 1912 and $14,162,107 in 1911. Just how all this exported material divides up it is hard to say, as out of the $21,000,000 about $12,000,000 is grouped as "all other," and there is now no indication in the returns as to where it goes. Moreover, some electrical apparatus or supplies are still excluded from this electrical class. But some data given are interesting, as, for example, the fact that 4877 fans were shipped away in September, or more than twice as many as went out a year ago. On the contrary, we exported in comparison fewer metal-filament and more carbon-filament lamps, which is curious, to say the least; and the total of the metal-filament lamps was only 85,954, valued at $20,235. When one looks at the enormous quantities of such lamps exported from some of the countries in Europe, he realizes that we are not yet "in it" in any kind of way worth mentioning, though the subject is certainly worth discussing, especially when it is noted that during the same month 645,082 metal-filament lamps were imported, or nearly twice as many as in September, 1913. That is a respectable figure, even if it does not represent a very large proportion of our consumption. Possibly 7,500,000 metal-filament lamps would be 15 or 20 per cent of those used annually in the United States. All of which makes us wonder as to why in the face of this we import so many, and why we cannot export more and import fewer.

German Central-Station Enterprise

Somehow it is hard for the American engineer fully to realize that he has not in effect a monopoly of huge central-station enterprises. Ours has been the country of great transmission systems and of colossal central stations to an extent that naturally overshadows a great deal that has been done elsewhere. Yet the brief account in our columns this week of a distributing plant in eastern Germany far over toward the Russian frontier and far off the beat of the tourist ought to awaken a sudden sense of appreciation. The interesting feature of the system is that it is a great network of underground cables supplied with energy from two large steam-driven stations, one of them already of 40,000-kw rating and the other of 25,000. In the principal plant, at Chorzow, there has just been installed a 20,000-kva horizontal turbo-alternator which is large even to the view of the most blasé central-station man, and another of these machines will be added to the equipment within the year. Energy is distributed at 6000 volts, with high-tension circuits wholly of underground cable, although the local secondary circuits are usually placed overhead.

In some of the larger industrial plants 6000-volt motors are in operation, receiving energy directly from the primary circuits, but the standard secondary pressures are 120 volts and 240 volts. The motor service of the system is on a very liberal scale. One rolling mill in the vicinity is equipped with six 2500-hp, three-phase motors, for example, and others are not far behind. The total output of the Silesian company's system for 1912 rose to 126,000,000 kw-hr., certainly a figure to command respect in a territory where there are no cities of the first rank. It would be extremely interesting to know the economic side of this 6000-volt underground distribution, the methods of construction used and the continuity of service obtained. In American practice for such service use would generally be made of a much higher voltage applied to overhead circuits, but there are not a few engineers who believe that with suitable precautions the underground service is more reliable. To these the Silesian system should be an object lesson worthy of further investigation.

British Municipal Undertakings

A correspondent in our columns this week discusses once more the much-mooted question of the central-station and railway enterprises carried on by municipalities in England. As everybody knows, there has been a tremendous lot of humbug about municipal enterprises both in America and England. Here a few municipal plants have succeeded, but many of them are merely unpleasant reminiscences. For a long time it was popularly believed that the British enterprises were much better managed and led to highly satisfactory results. That they have been better administered in the sense of being on the whole better able to keep predaceous politics out of the game there is little reason to doubt, yet, as our correspondent makes painfully evident, there is something to be said as to municipal methods which is not exactly complimentary. Our correspondent particularly points out that, as time has gone on, depreciation has become more and more a matter seriously to be reckoned with, and that adequate provision for this has, in some cases at least, not been made. The investigation carried out a few years ago in behalf of American interests brought out this fact in a very striking manner, and the result of a decade of experience has on the whole been to reduce the enthusiasm for municipal enterprises in Great Britain. Yet there is no discounting the fact that while municipal enterprises are, as our correspondent shows, somewhat handicapped, in the freedom with which they can go about their business, by parliamentary requirements, they have yet been able, not always but frequently, to make a good showing for economy of operation.

In this connection it should be noted that British municipal plants not only have to pay interest on their indebtedness but universally maintain a sinking fund for the repayment of loans that stand against the property. In other words, they are proceeding to put themselves in a position where they are able to write off the investment as the securities mature, and they very generally show over all of this a surplus which can be put to such use as the municipality sees fit. Similar private enterprises in this country, as everybody knows, usually do not maintain a sinking fund for that or any other purpose, and the accrued profits of the British enterprises which may be set off against depreciation are not to be despised. Perhaps, the British municipal plant is quite as scrupulous in charging off depreciation as is the ordinary privately owned central station in this country. If private plants had to make rigorous provision for taking care of their bonded indebtedness by a sinking fund instead of going on in the cheerful hope of increasing the bond issue when depreciation looms large, fewer plants than now would show comfortable profits for the stockholders. But, with all this, we are far from believing that municipal plants here are to be advised or fostered.

Roentgen-Ray Interference Phenomena

A salient phenomenon of wave motion is periodicity, or rhythmic repetition. It is possible, of course, to have a single wave, solitary and lonesome, like the sound-wave in air produced by striking an anvil once, and once only, with a hammer. But in the ordinary self-regulation of natural phenomena wave groups and wave trains are more frequent than single waves. Waves seem to prefer the company of their fellows and, like sorrows, come not as single spies but in battalions. This rhythmic characteristic quality of wave motion manifests itself both in time and in space. The former gives rise to the concepts of wave period and wave frequency, the latter to the concept of wave length.

One of the prominent features of wave length is that, with the aid of any source of phase difference, such as reflection from a barrier, waves of different phase, steadily arriving at a point, can be made to interfere. If we excite a tuning fork and rotate it slowly about a vertical axis of symmetry near one ear, a position can ordinarily be found at which the sound disappears, because the waves reaching the tympanum from one prong are in opposite phase to those coming from the other.

The capability of producing interference as above outlined becomes a critical test of the existence of wave motion. Thus incident light has been believed to be due to, and transmitted by, a wave motion, ever since Young and Fresnel first discovered the phenomenon of interference between rays of light. Prior to that discovery, light was supposed to be a direct emanation. If the corpuscular theory of light is ever revived, an explanation must needs be given by it for the accompanying wave motion.

When Roentgen rays were discovered various attempts were made, without success, to obtain experimental evidence of interference with them. It was then supposed that they were transmitted by wave motion, but that the waves were not rhythmic. Not following in orderly procession, they failed to show interference. Thus sound waves carrying pure musical notes can be made to reveal interference phenomena. But sound waves carrying pure noise, or nonrhythmic acoustic disturbances, baffle attempts to reveal interference. Interference is a by-product of orderly succession and of serried ranks. It will not consort with rabbles.

Quite recently, however, careful experiments in Europe have led to the discovery of interference phenomena in

Roentgen rays, so that our ideas concerning them have to be modified. It now seems that they are periodic and are not merely isolated pulses of ultra-ultra-violet light. Only their frequency is yet more bewildering to the quantitative imagination than that of light. The frequency of mid-spectrum visible light is apparently about six hundred millions of millions per second, so that if we represent the millionth of a meter by the symbol μ, the mid-wave length of visible light is about 0.5μ. But, judging from the new interference phenomena of X-rays, the frequency of these rays is perhaps fifty thousand times as great as the above, or about thirty millions of millions of millions per second. If we use another μ to represent another millionth subdivision of a meter, so that 1μμ shall represent the millionth of a millionth of a meter, then the X-ray wave length comes out about 10μμ.

The interference phenomena produced have been revealed photographically both by filtering Roentgen rays through thin sheets of crystalline substance and by reflecting them from crystalline surfaces. Some of the photographs thus secured are of great beauty and interest. They bear promise of leading eventually to an unraveling of the mystery of molecular structure in crystals, but the experimental and mathematical difficulties in the path of this inquiry are numerous. The experiments are described in the papers and discussions of the eighty-fifth Natural Science Convention of Europe, which was held in Vienna last September, as published in the *Physikalische Zeitschrift* of Nov. 15, 1913.

Where Holding Companies May Lead

As recent financial conditions have resulted in a cessation in the growth of holding companies, now is a good time to consider the directions which this movement may take. That the movement will be started again when the money market favors the use of capital for such purposes is warranted prophecy. The opportunities for economy in consolidated operation are too inviting to be ignored. It is, therefore, reasonable to assume that representatives of large holding interests are studying independent properties in order to be ready to make purchases when the money and securities markets are in the psychological state necessary for the flotation of stocks and bonds. The strength of the holding company movement lies in the promise of securing better and more economical results from a group of operating companies than those properties can give if operated as individual units. The weakness lies in the temptation to use these undeniable operating advantages as a cloak to cover the issuance of more securities than the properties should be required to support. The dangers of the movement should be clearly understood, because to understand them means to realize that there is a responsibility for the avoidance of them that no syndicate can refuse to accept. These dangers are not materially different in kind from those that exist in individual central stations, but they are different in degree. As there is opportunity for defects in service and for losses due to improper financing in small plants, so there is the same opportunity for these fundamental errors, but in a scale involving widespread disaster, in aggregations of plants. Likewise, where there is a chance for small profit on a small plant there is a correspondingly increased chance for a large profit in many plants combined, and this is further increased by the benefits of consolidation.

The basis of the holding company's excuse for existence is the individual operating plant. A single plant may be subjected to just as much mismanagement in the hands of local capitalists as in the more remote hands of a central holding company. In either case the business may be exploited unwisely and unduly. The apparent profits reported may be inconsistent with the amount of business done. If so, examination may show that they are made up in part of sums which should have been applied to maintenance and that if full allowance were made for maintenance the operating surplus would be greatly reduced. Because of the greater experience which it has with the life of physical property and with market prices of materials, the holding company should be better able to determine a fair ratio for operating expenses than the single plant. If, in spite of its knowledge, it deducts from income a sum for operating expenses that is insufficient to care for all elements of maintenance, it may present an unreal surplus. If the impropriety of such a surplus is disregarded, it appears to be available for distribution. We think, however, that there is fully as much opening for the misuse of surplus in the independent company as in the syndicate-controlled company. In both cases the payment of dividends based on an improperly determined book surplus gives a fictitious value to the capital stock on which the dividends are declared. The management of a small company which has been guilty of this policy may plead, sometimes truthfully, that it was ignorant and did not know its error. The holding company is not entitled to make such a plea. It ought to be scrupulously exact in its calculations of profits. Because it is, in effect, an "absentee landlord" and may at some time be forced to incur the public feeling that might develop where that relation exists, it ought to be even more careful in the financial policy of its subsidiaries than the home directorate of an independent company would be under the same circumstances.

We are aware that these matters have not always received consideration in the development of systems of holding companies. We appreciate the fact that the physical success of some of the large consolidations necessarily comes, if it comes at all, from the complete destruction of existing inadequate plants and the use of modern apparatus and methods to take their places. Such improvements, however, should not obscure the issues. The capital accounts should be protected and the revenues should not be required to meet dividends on unjustifiable capitalization. If the holding company is made an agency for the exploitation of properties and the sale of more securities than are warranted by the value and business of its underlying operating properties, it will do the industry more harm than good and its end should be decreed. If, however, it is an agency for the proper economical management of groups of plants on a closer basis than they can be operated separately and its practices technically and financially are sound, it will be a great and welcome factor in the sure development of the industry.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Congress Passes Hetch-Hetchy Bill

The Raker bill, giving the city of San Francisco water supply and power rights in the Hetch-Hetchy Valley of the Tuolumne River, Yosemite National Park, was passed by the Senate on Dec. 6 at midnight. The bill had previously passed the House of Representatives in identically the same form and is now in the hands of the President. San Francisco receives its water supply from a private water company, and if the Raker bill is signed by the President it will enjoy unlimited pure water owned by the city and brought from the Yosemite, 142 miles away. The Hetch-Hetchy project will also enable the hydroelectric generation of 300,000 hp. Wide opposition to the measure has been manifested.

Co-operation with Electric Garage Owners

A joint meeting of the Chicago Section of the Electric Vehicle Association and the Chicago Garage Owners' Association was held on Dec. 2. There was considerable discussion relating to co-operation between the electric-vehicle men and the garage owners, and a resolution offered by Mr. W. J. McDowell, secretary of the Chicago Section of the Electric Vehicle Association, was adopted. This resolution recites that the Chicago Section of the Electric Vehicle Association approves the excellent work done by the Chicago Garage Owners' Association in bettering garage conditions in Chicago and affirms further that the Chicago Section does not hold itself responsible for statements made at its meetings.

Safety Conference in New York

The first annual conference of the American Museum of Safety, which is being held in connection with the International Exposition of Safety and Sanitation, began Wednesday in the Chemists' Club, New York City. Mayor Kline was unable to be present to preside, and Mr. George McAneny, president of the borough of Manhattan, took the Mayor's place and delivered an address. Dr. William H. Tolman, director of the American Museum of Safety, delivered an illustrated lecture on "Safer Shops." He had thrown on the screen pictures of industrial conditions in Europe and America.

Mr. Arthur Williams, president of the Museum of Safety, succeeded Borough President McAneny as chairman of the meeting. He presented the next speakers, Messrs. Don C. Seitz, of the New York *World;* J. F. Conner, assistant manager claim department United Gas Improvement Company; Mrs. Florence Kelley, secretary of the National Consumers' League; H. F. J. Porter, and others. The morning session closed with motion pictures from the Bureau of Mines, showing methods of rescue work. The slides were explained by Mr. J. R. Fleming.

Dr. Charles A. Doremus was chairman at the afternoon session on Wednesday, when the general subject "Accident Prevention and the Public" was discussed. Mr. R. H. Newbern, superintendent insurance department Pennsylvania Railroad, was the first speaker, and he was followed by Dr. William O'Neill Sherman, chief surgeon Carnegie Steel Company, who talked on "Care of Injured Employees."

Dr. Lucian W. Chaney, of the Bureau of Labor Statistics, Department of Labor, spoke on the subject of "Taking Chances."

Mrs. Rose Pastor Stokes, known as a social worker, speaking of the movement for safety on the part of the great industrial corporations, said the greatest danger lies in the measure of speed with which desired ends are attained. What is called "industrial efficiency" is merely speeding up to rapidity and accuracy at such a pace that those affected are not able to endure it for many years.

Other speakers at Wednesday's session were Messrs. Marcus A. Dow, general safety agent of the New York Central Lines; James O. Fagan and Edward Bunnell Phelps. Following the addresses, Dr. Richard Kearney exhibited lantern slides showing public-health service.

The conference was continued through Thursday and Friday and ended with a dinner and presentation of medals at the Waldorf-Astoria on Friday night.

Report of Attorney-General McReynolds

Attorney-General McReynolds, in his annual report to Congress, says that violations of the anti-trust law are being reported constantly and that an organization is being perfected through which substantial complaints may be investigated promptly and violations of the act dealt with speedily and vigorously.

There are now pending forty-nine cases under the Sherman law, thirty-seven civil and twelve criminal. Of these six were brought under the present administration.

The Attorney-General declares his adherence to the principle laid down in the Union Pacific Railroad case to the effect that the separate parts of an unlawful combination must not be allowed to remain under the control of the same set of men.

Meeting of Executive Committee of Commercial Section, N. E. L. A.

The executive committee of the Commercial Section of the National Electric Light Association met in the main building of the National Electric Lamp Association at Nela Park, Cleveland, on Monday of this week. Reports were received from committees on electric merchandising and advertising, development of non-peak load, wiring of existing buildings, membership, education and publications. The detailed report of the latter committee showed that during the month of November the Commercial Section disposed of the largest number of publications. According to the report of the membership committee, more than 100 applications have been received since the last meeting in October. Chairman T. I. Jones appointed a committee from the Commercial Section to act jointly with the lamp committee appointed by President McCall of the parent body to draw up a report to be read at the commercial session on the development and use of incandescent lamps as viewed from an executive and commercial standpoint, together with a report on the results of the companies' policy in placing on a free-renewal basis tungsten lamps of 100 watts rating and over.

The new constitution of the Commercial Section was approved at the Cleveland meeting. It was announced that the revised Electric Salesman's Handbook will be issued shortly after the first of January and will contain data on 1000 installations. Through the courtesy of the General Electric Company, a complete directory of all members of the Commercial Section will be issued shortly. The committee was entertained at luncheon by the National Electric Lamp Association.

Brooklyn Edison Company to Continue Profit-Sharing

At a meeting of the Brooklyn Company Section of the National Electric Light Association on Dec. 9 Vice-president and General Manager W. F. Wells, of the Edison Electric Illuminating Company of Brooklyn, announced that the directors of the company at their last meeting had voted to continue for the present year the policy of profit-sharing which had been in force for three years previous. This involves the distribution among over 900 employees of approximately $60,000. The profit-sharing is made on a basis of years of service, the employee who has been with the company two years receiving 2 per cent of his annual salary and the employee of five years or more 8 per cent, with varying percentages between. This year more than 400 employees will receive 8 per cent on their salaries.

Much of the employees' profit shares of previous years is invested in the Edison investment fund, conducted by the company without any administrative charges, and it has been paying employees 6 per cent compounded quarterly. This fund, with the profit-sharing of 1913 added, will exceed $300,000, the property of approximately 1100 employees.

The speaker at the meeting Tuesday night was Mr. Andrew McLean, editor of the *Citizen*. Mr. McLean gave an address on "Relations Between Employee and Employer, Between Capital and Labor, from Historic, Economic and Social Viewpoints." His address delighted the 500 members of the section present and at its close he received a rousing vote of thanks.

Meeting of the Alabama Light and Traction Association

The annual meeting of the Alabama Light and Traction Association was held on Nov. 21, 1913, at the office of the Mobile Gas Company. Mr. R. L. Ellis, manager of the Selma Lighting Company, was elected president of the association; Mr. T. K. Jackson, manager of the Mobile Electric Company, was elected vice-president, and Mr. H. O. Hanson, assistant manager of the Mobile Gas Company, was re-elected secretary and treasurer. The names of the members of the executive committee of the association elected at the meeting follow: Messrs. A. H. Ford, manager of the Birmingham Railway, Light & Power Company; C. C. Henderson, the former president of the association; C. E. White, manager of the Montgomery Light & Water Power Company; R. L. Rand, manager of the Anniston Electric & Gas Company, and A. R. Smith, general manager of the Demopolis Electric Light & Power Company.

The session of the association was concluded with a banquet on the evening of Nov. 21 in the Cawthorn Vineyard, tendered to the delegates by the officers of the Mobile Electric Company and the Mobile Gas Company. After the address of Mr. C. C. Henderson, of the Henderson Light & Power Company of Greenville, president of the association, Mr. R. H. Smith, manager of the Greensboro Water & Light Company, read a paper on "The Operation of a Power Plant in a Small Town." Mr. T. K. Jackson introduced the subject of "Some Pertinent and Impertinent Questions." Mr. R. L. Ellis read a paper on "The Oil Game."

New York Electrical Credit Men Hold Annual Meeting

The annual meeting and banquet of the New York Electrical Credit Association was held on the evening of Dec. 9 at Fraunces' Tavern, New York. There were ninety-five present at the meeting, which proved enjoyable and helpful. Mr. N. S. Colby, president of the American Ever Ready Company and retiring president of the association, was chairman of the meeting and Mr. F. E. Wurzbach acted as toastmaster. The program included addresses by Messrs. J. H. Tregoe, secretary of the National Association of Credit Managers; C. M. Wilkins, president of the National Electric Credit Association; W. E. Rice, credit manager of the Western Electric Company, and Franz Nielson, secretary of the association. At the business session Mr. J. H. Dale was elected to the board of managers and Messrs. J. W. Smith, of the General Electric Company, and James Goldmark were chosen for vacancies in the board of directors. The officers elected for the ensuing year were Messrs. W. F. Irish, president; G. E. Chapin, vice-president, and Franz Nielson, secretary and treasurer.

Since its inauguration this association has given warnings to its members of 10,500 persons who have proved unworthy of credit or delinquent regarding the settlement of bills or disputes of a commercial nature. During the past year the association has handled for its members 3066 accounts, involving $331,383, and has secured adjustments in the case of 2887 of these accounts, representing $250,367.

Public Utility Regulation

Mr. John M. Eshleman, president of the Railroad Commission of California, in an address before the California Bar Association at Los Angeles recently laid down the following principles on public utility regulation, which, coming from such an authoritative source, and in view of the renewed general interest in public utility legislation, are worthy of close consideration:

"All men should have the right to the acquirement at least of the necessities on reasonable terms, and no man shall be permitted to indulge his selfish inclination to get as much as he can for his commodity or his service in such a manner as to deprive his fellow of the opportunity to get the necessities of life on reasonable terms.

"Monopoly in some form is essential to constitute an agency or a public utility.

"Agencies become public utilities independent of a desire of the owners of such agencies and irrespective of any voluntary devotion of their property to public use.

"Owners of public utility property hold such property by a tenure different from that of other owners.

"The amount of money wisely invested in a public utility property is the best evidence of value for rate-fixing purposes and is the controlling element in determining the amount on which a utility should be permitted to earn.

"If we put a restriction upon public utility business and clouds upon public utility property, public authority has a reciprocal duty to protect these utilities and their property from injustice on the part of their patrons.

"Such being the fact, the public has a right to expect the business to be carried on at reasonable terms, and the public should not give any more reward to these private agencies carrying on this public business than is necessary to get the business done. If public utility business is to be done by private capital, the public should hold out only

those inducements which are required to get the necessary amount of capital into the business. If it is required to hold out excessive inducements, then the doing of this business by private capital is too expensive, and unless there are corresponding disadvantages which more than offset this expense, then it certainly would be better for the state to do this business for itself. The issue between private and public ownership of utilities will be fought out right here, and the wise public utility manager who does not believe in public ownership of public utilities should see to it that private enterprise performs the service as adequately and at as reasonable rates as public authority could hope to do.

"Fair play and sound financial practices on the part both of the public and of the public utility are absolutely necessary for the permanent welfare of the utility as well as of the public. I am fully of the opinion that public authority should assume an attitude of helpfulness and co-operation, and if it be determined that rates of the great railroad systems, for example, must be raised, then let us raise them and apply the remedy. But if, on the other hand, after careful and impartial study, we find another remedy needed, let us with equal firmness apply it, even though it be less palatable to the patient."

Public Relations Discussed by New York Electric Railway Association

The quarterly meeting of the New York Electric Railway Association, held at the United Engineering Societies Building, New York, on Dec. 9, was devoted entirely to the subject of public relations. Several papers were presented, and in addition there was a full informal discussion of the topic.

The first speaker was Mr. Edward E. McCall, chairman New York Public Service Commission, First District, who welcomed the delegates and expressed his realization of the fact that meetings of this character necessarily tend to bring about beneficial results. He said that the old order of events has come to an end and a new and wiser method is in vogue. Under the present laws publicity is practically compulsory. A fair, upright treatment and recognition of the rights of all concerned will be the guiding rules in the disposition of cases before the commission.

Mr. J. H. Pardee, president J. G. White Management Corporation, said that after many costly trials of municipal ownership the public has found that the most expedient and practical means of control of the public service corporations lies in their development by private capital, together with proper and fair commission regulation representing the public interest. Unreasonable regulation can, in the long run, harm no one but the public itself, for it automatically increases the rate at which money can be drawn into this field of investment and hence the rates which the public must pay for service.

Mr. J. C. De Long, president Syracuse Lighting Company, said that a great many of the difficulties concerning relations with the public arise from a lack of knowledge on the part of the public of the peculiar conditions under which the business must be handled. One difficulty often encountered is a feeling on the part of employees in their treatment of the public that the company is always right. This is a wrong frame of mind for employees to have. Where public utilities are in the wrong the best thing to do is to confess it and clear up the situation.

Mr. C. Loomis Allen, of Allen & Peck, Inc., defined good public relations and bad public relations and outlined the methods of publicity which a company should follow in order to effect a public understanding of their problems. He advised that a creed be adopted to represent the attitude of the association and its member companies on the general principles of public policy. In taking steps to establish good public relations the company must have first of all the facts in relation to its business. It must be willing to state the facts frankly and in terms that the public understand.

Among others who spoke were Messrs. C. S. Sims, J. P. Barnes, Frank Hedley, William H. Hyland, A. K. Baylor, L. S. Storrs, E. F. Peck, Ernest Gonzenbach, H. W. Blake, H. H. Vreeland, E. S. Fassett, S. P. Smith and J. J. Dempsey.

Postmaster-General on Government Ownership of Telephone and Telegraph Lines

Postmaster-General Burleson announced in Washington on Dec. 9 that he had discussed with President Wilson that day the general subject of ultimate government control of telegraph and telephone lines. He said that he and the President were open to conviction as to the justification for federal acquisition of these lines, but that at present it would seem to be unwise to make plans for this multiplication of the functions of the Post Office Department.

He added that until the valuation of railways had been finished, or at least until a sufficiently comprehensive and accurate preliminary report had been provided upon which to base calculations of income and expenditures, only the barest tentative position could possibly be taken by the authorities.

Mr. Burleson said that to assimilate the telephone and telegraph business would mean the taking over of properties worth more than $200,000,000 and possibly approaching $300,000,000.

Mr. Burleson was quoted as follows: "The Democratic party has always approached big questions cautiously. It is essential that we make haste slowly. The President and I both believe that a thorough and exhaustive study should be made, not only in this country, but abroad, before we undertake to decide upon anything definite.

"Already such an investigation has been started by the Board of Physical Valuation, and recently I had two long conferences with Mr. Herbert Samuels, head of the English postal system, regarding the government-owned telegraph lines in that country. The systems in other European countries must also be studied."

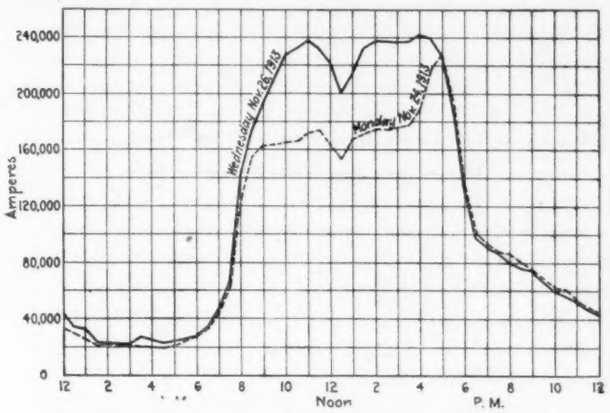
Representative Lewis, of Maryland, is preparing a bill providing for government ownership of telegraph and telephone lines.

Effect of Chicago's Recent Dark Days on Edison Load Curve

During the last week of November a heavy black cloud of fog and smoke hung over Chicago, making the days almost as dark as the nights. In consequence many electric signs were in operation on the streets, and all day long the lighted windows in the Loop office buildings shone through the murky atmosphere. The effect of this sort of day on the business of the Commonwealth Edison Company is shown in the accompanying load curves of the low-tension district. On Nov. 24, a clear day, the combined lighting and motor-service load on the low-tension downtown distribution system reached a peak value of about 230,000 amp late in the afternoon, but on Nov. 26, when it was very dark, the load on this portion of the system rose to approximately 240,000 amp in the morning, remaining at that value throughout the day except for the customary noon-hour depression. Since both curves contain the motor-service portion of the load it will be seen that the increase was due almost entirely to the heavy lighting load on the dark day.

Although the output of the electric-service company's

stations was high on Nov. 26, the record peak for the fall business occurred on Nov. 11 as the result of the heavy railway load supplied. Here also weather conditions were a factor in the results. Nov. 11 was a fair day, but its prevailing low temperature necessitated the operation of electric heaters in the railway cars for which the Edison company sells service. To this railway-heating load is therefore attributed the credit of producing the largest kilowatt-hour output for any day of the fall season.



DARK-DAY AND NORMAL LOAD CURVE IN CHICAGO LOW-TENSION DISTRICT

Opportunities for Electrical Development Discussed

One hundred and fifty representatives of the central-station, contracting, jobbing and electrical manufacturing interests in New England convened at the American House, Boston, on Dec. 5 to discuss plans for larger co-operation in the development of the industry, Mr. James D. Andrew, of the Boston Edison company, being in the chair.

Industrial Power Market

Mr. S. St. John Morgan, of the Westinghouse Electric & Manufacturing Company, Boston, presented a paper on the industrial power market in America, pointing out that in 1910 there were 22,000,000 total mechanical hp in use in the United States, of which 22 per cent was supplied by electric motors. It is estimated that by 1920 a total of 44,000,000 hp will be in use and that 60 per cent of this will be electrical. The opportunities in a single city like Fall River, Mass., where 120,000 mechanical hp are in use in the textile mills, are most attractive. In this one moderate-sized city the possible load for electrification exceeds the total power load of many of the largest central-station systems. In the Boston metropolitan district there remain to be electrified at present 186,000 mechanical hp, despite the fact that three central stations in this district now have a combined connected motor load of 103,000 hp. The writer advocated a larger co-operation on the part of motor manufacturers and jobbers in the direction of insuring correct installations as regards power-factor and load-factor. Motor selection directly affects central-station investment.

Lamp Renewal Policies

Mr. E. R. Davenport, Narragansett Electric Lighting Company, Providence, R. I., read a paper vigorously advocating the better education of electrical salespeople and contending that the free supply of lamps of any kind should be discontinued as a practice of the Dark Ages. The author averred that the public's willingness to purchase gas mantles should be transferred to the electrical industry and made the point that there is no logical reason for free lamp supply other than the time-honored explanation "We have always done it." Central stations would be more popular if they sold energy for lighting at a lower price per kilowatt-hour and charged the customer separately for lamps. Mr. Davenport thought that there was not the slightest cause for worry on the part of the central stations as to the effect of 10-watt and 15-watt lamps in residential service, the result of cheaper energy always being to increase sales. He condemned the policy of running tungsten lamps at sub-normal voltage to increase their life. An analysis made by the Providence company of lamp policies in Wisconsin gave the following results: Eighteen companies provide free initial installations and fifty-eight do not; twenty-three give free renewals and fifty-nine do not; sixty-seven companies charge from 20 cents to 25 cents each for carbon-lamp renewals; four supply tungsten lamps below cost, twenty-five supply these at cost, and forty companies charge customers something more than cost. In Cleveland and Minneapolis free renewals are not allowed, and among thirty companies operated by H. M. Byllesby & Company, of Chicago, in 200 municipalities, only about half give free renewals, the idea being ultimately to enforce a charge for all lamps.

Co-operative Movement

Other speakers were Mr. F. S. Price, Pettingell-Andrews Company, Boston; Mr. A. J. Hixon, Hixon Electric Company, Boston; Mr. H. T. Sands, general manager C. H. Tenney & Company, Boston; Mr. C. D. Williams, Simplex Electric Heating Company, Cambridge, Mass., and Mr. J. M. Wakeman, general manager Society for Electrical Development, New York. The last speaker pointed out that less than 20 per cent of the residences in the United States in reach of central-station service are wired for electricity and that but 1 per cent of the homes of the country are fully wired. He described the plans afoot for the development of the market for electricity, including an educational advertising campaign in the popular magazines, articles in trade papers by experts on the development of motor service in particular industries, moving-picture films showing electrical applications in factories, homes and on the farm, and the use of an electrical demonstration car illustrating the "house electrical." Mr. Wakeman pointed out that a campaign of this kind can be conducted only through some large national organization such as the Society for Electrical Development, Inc. He urged the formation of a local luncheon club or similar organization to work in conjunction with the Society for Electrical Development.

Report on National Civic Federation Model Public Utility Law

Mr. Emerson McMillin read a report before the National Civic Federation in New York on Dec. 11 as chairman of the department on regulation of interstate and municipal utilities. He outlined the various steps taken in the compilation of the model public utility bill of the federation.

That the regulation of public utilities is necessary is no longer a debatable question, Mr. McMillin said. The business which they conduct is closely related to the public welfare. The best interests of the public will be conserved ordinarily by the conduct of such business only as a monopoly. Managers of public utilities no less than other members of the public realize that without recognition of the common interest in the conduct of such business conditions might eventually become intolerable; in fact, it has come to be generally believed that regulation of public utilities is the alternative to public ownership and operation. No one of the important public utilities has reached a point where in the interests of the public it can dispense with the initiative, zeal, enterprise and courage which in the past have characterized American business methods.

Accordingly the bill which the department prepared is an

indorsement of the principle of state regulation of public utilities. It stands squarely for the public interest in these matters. The commission may investigate and fix absolute rates. It may prescribe absolute standards of service and require adherence thereto. It is required to provide uniform accounting and statistical methods, and companies are obliged to make such reports to it as the commission may desire. It is charged with the responsibility of approving issues of stocks and bonds and the transfer of property and franchises from one company to another. These powers and others are conferred on the commission in the firm belief that their exercise is required under a system of adequate regulation, but with the belief that their abuse will be as destructive, ultimately, to the public interest as it may be immediately to the private interests of the companies regulated.

Mr. McMillin added that the bill provides for a single state commission to undertake the regulation of all utilities within the State. This plan is believed to be eminently preferable to any scheme of divided jurisdiction whether on territorial lines or on business lines. Municipal regulation of local utilities must necessarily be expensive and probably inefficient. Utilities no longer are confined to the limits of municipalities. Of even greater concern, however, is the difficulty, if not impossibility, in a majority of cases of obtaining through a municipal regulating body the degree of scientific accuracy and judicial impartiality and fairness which is necessary to a proper solution of public utility problems.

Continuing, Mr. McMillin said that the bill throws about existing investments the protection from competition offered by the requirement that a certificate of public convenience and necessity issue from the commission before a new enterprise is begun in competition with an old one. This provision summarizes the experience of a number of states. Competition in a field which lends itself naturally to a monopoly is economically and socially wasteful. The rule apples as well whether the proposed competitor is a private company or a municipality. So long as an existing agency is furnishing adequate service at just and reasonable rates in all respects in compliance with the provisions of the public utilities law, there can be no justification for the introduction of competing agencies.

The bill strikes a blow at another abuse which has cost the people of this country humiliation, political disease and the propagation of graft, which results from the short-term franchise requiring renewals at periodical intervals. A modification of the Massachusetts plan with respect to new franchises granted after the passage of the act and slightly less extreme than the Wisconsin plan with respect to franchises existing when the act takes effect—the bill takes a long step in the directon of sanity in the adjustment of the important franchise relationship.

Mr. McMillin called attention to the fact that an important feature of the indeterminate franchise principle is the provision made for the termination of franchises by municipal purchase. Full opportunity is afforded to municipalities to purchase the property of utilities operating under indeterminate grants for a price and on reasonable terms and conditions determined by the commission. Municipalities are authorized either to operate public utilities so acquired or to contract with private companies for their operation. Every municipality that owns a public utility is required to keep uniform accounts prescribed by the commission and to report to the commission as private companies are required to do.

The model bill as submitted is the result of arduous and long-drawn-out investigation and consideration, said Mr. McMillin in conclusion. It is of necessity a compromise production. Each and every member of the council objects to some feature of the bill, but, as a whole, it has finally received the vote of the entire council, with one single exception.

The Physics of Lighting

Dean F. L. Bishop of the engineering department of the University of Pittsburgh presented a paper on the "Physics of Lighting" before the Pittsburgh Section of the Illuminating Engineering Society, Nov. 28.

Various methods of producing the physiological effect of light were discussed by the speaker, who defined the normal eye as being equally sensitive to red, blue and green light. A black body heated to 6000 deg. C., he said, gives these light values in equal proportions, producing white light, but such a temperature is not commercially practicable. The color composition of some familiar light sources are presented in the following table:

	Red	Green	Blue
Light from north sky	32.2	32.2	35.8
Overcast sky	34.6	33.9	31.5
Afternoon sun	37.7	37.3	25.0
Hefner candle	55.0	38.8	6.2
Carbon incandescent lamp	51.3	40.4	8.3
Mercury-vapor lamp	29.0	30.3	40.7
Moore lamp, with carbon dioxide	31.3	31.0	37.7

Curves exhibited by Dean Bishop showed the changes in the color of light accompanying rise in temperature. At 2000 deg. C., for example, red light is produced, while at 8000 deg. C. blue results. Recent theories of the fundamental nature of light production were touched upon by the speaker, who outlined the character of the electronic vibrations occurring within the atom and giving rise to luminous phenomena. Such electronic vibrations may be set up by electrical, thermal or chemical means. The simple physics of light reflection and refraction were also discussed, and the speaker closed with a historical sketch of various illuminants, traced down to the modern high-efficiency units in which selective radiation plays an important part.

Mr. G. D. Kammer, of the Standard Chemical Company, Pittsburgh, who was then introduced by Chairman C. J. Mundo, described some of the properties of radium, the propagation of the alpha, beta and gamma rays, the logarithmic decay of radioactivity, etc. The speaker also exhibited samples of radio-active and phosphorescent materials.

The Fire Hazard in Turbo-Generators

A paper on "The Fire Hazard in Turbo-Generators" was read by Mr. G. S. Lawler, electrical engineer for the Associated Mutual Fire Insurance Companies of Boston, Mass., at the Dec. 5 closing session of the New York winter meeting of the American Society of Mechanical Engineers, the earlier sessions of which convention were reported in our issue of Dec. 6.

The chances of electric generators of the older engine-driven type being seriously injured by fire in the event of failure of insulation is very slight, said Mr. Lawler. Occasionally arcing ignites their insulation at some point, but seldom does the fire spread before it is extinguished. In the newer turbo-alternators, however, there exists a great hazard that serious fire damage will follow arcing. The reasons for this are the large amount of exposed, concentrated, combustible material in the generator insulation, the large amount of energy usually involved in a short-circuit of such a large machine, the quantity of oxygen being blown into the machine with the cooling air, and the inaccessibility of the burning parts. Such arcing may occur in turbo-alternators from a variety of causes, among them distortion of stator coils and injury to insulation caused by

heavy current rushes. Generators provided with sufficient reactance to limit the current flow may not give trouble until near the end of their life, when short-circuits from ordinary causes may be expected.

To reduce the possibility of fire damage, Mr. Lawler proposed that all exposed coils be provided with non-combustible outer coverings, that the cooling air be filtered to free it of oily vapors, and that in case of fire the blast be automatically cut off by the closing of dampers released by fusible links, while at the same time carbon dioxide or other inert gas be introduced into the machine to extinguish combustion. Carbon dioxide, it was suggested, might be kept ready in liquid form, being piped through valves, expansion tanks, etc., to the generators for emergency use.

Discussion

Mr. B. F. Lamme, Pittsburgh, Pa., transmitted a written discussion, read by Mr. H. W. Flashman, in which approval was expressed of the ideas contained in the paper, while emphasis was laid on the fact that fires in turbo-generators have been found to occur with much greater frequency in large machines and in those operating at high voltages. This percentage of relative damage persists even in spite of the fact that most of the smaller machines are older than the large units and have therefore had more time to undergo insulation depreciation. Mr. Lamme reported experiments in which attempts were made to delay combustion by the use of asbestos coverings, but he declared that where the arc was sufficient to gasify the insulation the fire was found to spread about as rapidly with as without the non-burning cover. Asbestos tape, in fact, he said, is now believed to introduce a positive element of danger. Taking up Mr. Lawler's suggestion that dampers be arranged to shut off the cooling air blast, Mr. Lamme questioned whether the percentage of leakage remaining even under the best conditions of damper closure might not still be sufficient to fan the flames. A small quantity of CO_2 would have little effect in smothering fires of this kind. Improper action of automatic devices might actually result in the exact damage to the turbo-alternators which these devices were designed to prevent. For example, large turbo-generators require a large continuous supply of cooling air, and in the case of even momentary interruptions to this supply such machines quickly overheat. In the event of accident to the fusible links proposed by Mr. Lawler, the dampers would automatically close, at once interfering with the normal cooling action and causing the machines to overheat, possibly with dangerous results. Mr. Lamme suggested that the blower motors be operated from the turbines which they cool. This arrangement would always insure the operation of the blower as long as its turbine was in service, while in case of either an external or an internal short-circuit the blower would be automatically shut down, shutting off the air supply.

Mr. I. E. Moultrop, Boston, Mass., referred to the rapidity with which trouble in a turbo-alternator may spread. He declared that the present topic was one for electrical engineers to treat, and that the A. S. M. E. should restrict itself to discussions in its own field.

Mr. P. S. Lincoln, Pittsburgh, Pa., told of the difficulty he had encountered in attempting to get the Underwriters to insure the windings of generators against damage from fires originating within themselves.

Mr. F. E. Cardullo, New York, suggested that steam be introduced into the generator casing to stifle fires in the windings, since this fluid in large quantities is always immediately available at the turbine. As wet steam would be more advantageous than the superheated vapor he suggested bleeding the extinguishing supply from one of the later turbine stages.

Mr. H. G. Reist, Schenectady, N. Y., pointed out that there is little to be expected from putting fire-resistant material on the windings, since in any case these soon become soaked with combustible matter. To show how readily an incombustible material can contribute to combustion, Mr. Reist cited an instance in which an oil-soaked cement floor burned as fiercely as other wooden parts of the same building. He recommended that if the blast cut-off were used the automatic damper be arranged both to close the blast inlet and at the same time short-circuit the outlet, thus leaving inert air to be circulated within the machine.

Mr. Albert Blauvelt, Chicago, suggested that completely burned chimney gases, previously cooled, might be admitted to the turbo-alternator casing to drown out an incipient fire.

Mr. R. D. DeWolf, Syracuse, N. Y., observed that, regardless of the oxygen supply in the surrounding atmosphere, the insulation inside the machine might easily be destroyed if the heat were great enough.

Mr. George I. Rockwood, Worcester, Mass., commented briefly on the proposals to turn high-pressure steam and chimney gases into the casings of turbo-alternators.

Mr. Selby Haar, New York, reminded the audience that good fire-resistant materials are almost invariably poor thermal conductors and that therefore this use will be objected to by electrical designers who aim to have their machines operate with the greatest possible free radiation.

In closing the discussion, Mr. Lawler said that the proposed use of non-combustible coverings would not be intended to prevent the spread of fire but to retard it until other means of extinguishing the destruction could be brought into play.

Public Service Commission News

WISCONSIN COMMISSION

Upon the recommendation of the Wisconsin Railroad Commission, the Madison Gas & Electric Company has reduced its rates for electric lighting in Madison. The new schedule, which goes into effect immediately, is as follows: Primary rate, 10 cents per kw-hr. instead of 12 cents; secondary rate, 6 cents instead of 8 cents; excess rate, 2 cents instead of 4 cents. The recommendation was originally submitted to the company nearly a year ago with the understanding that the reduction would not go into effect until assurance had been received from the Common Council that the pending contract for street lighting would be settled in a manner satisfactory to the company and the commission. This is the third material reduction which has been made in the electric rates of the Madison Gas & Electric Company within about three years.

The commission has ordered the Clinton Telephone Company and the Bergen Telephone Company to make joint use of certain toll lines and has reaffirmed its previous decision concerning the rates for joint toll service. The decision notes that the Bergen Telephone Company is furnishing service to a small number of subscribers in the city of Clinton and orders the practice stopped.

INDIANA COMMISSION

The Public Service Commission of Indiana will receive a petition soon from the Central Union Telephone Company asking permission to increase rates on practically all telephone service in Indianapolis.

Citizens of South Bend have petitioned the commission to decide whether the terms of a proposed new contract with the Indiana & Michigan Electric Company by the city authorities for furnishing street lights for South Bend are reasonable. They contend that the rates are not reasonable and that individual lighting bills are too high. A general revision of rates and the prevention of the proposed ten-year city lighting contract are asked in case the commission finds the charges excessive.

The commission has been informed that the Princeton Water & Lighting Company desires to surrender its franchise and take an indeterminate permit.

Current News Notes

Engineer Urged for Illinois Commission.—The Illinois Society of Engineers and Surveyors has presented a petition to Governor Dunne asking for the appointment of at least one engineer on the Public Service Commission, which is to take office the first of the new year.

* * *

Engineer for Interstate Commerce Commission.—The American Institute of Consulting Engineers through Mr. Alfred Noble, the president, and Mr. Eugene W. Stern, the secretary, has addressed a letter to President Wilson asking for the appointment of some able and experienced engineer to fill one of the vacancies on the Interstate Commerce Commission.

* * *

Bill for Regulation of Interstate Hydroelectric Properties.—A bill has been introduced in the House of Representatives by Mr. William L. Igoe, Congressman of Missouri, which is designed to give the Interstate Commerce Commission regulation of the rates of hydroelectric companies engaged in interstate business. Congressman Igoe made a statement in connection with the introduction of the bill in which he said that the expected reduction in price of electric energy had not ensued as a result of the hydroelectric development at Keokuk.

* * *

SOCIETY MEETINGS

Pupin Before New York Electrical Society.—Dr. Michael I. Pupin will deliver a lecture before the New York Electrical Society in the Engineering Societies Building on Dec. 18 at 8 p. m. His subject will be "The Science and Art of the Pupin Coil."

* * *

Atlanta Meeting, A. A. A. S.—The mid-winter meeting of the American Association for the Advancement of Science and affiliated societies will be held at Atlanta, Ga., from Dec. 29, 1913, to Jan. 3, 1914. The president of the association is Dr. Edmund B. Wilson, Columbia University, New York. The permanent secretary is Mr. L. O. Howard, Smithsonian Institution, Washington, D. C.

* * *

Jovian Theater Party at Philadelphia.—Philadelphia members of the Jovian Order will give a theater party Dec. 18 to witness a performance of "The Ghost Breaker." Mr. Washington Devereux is chairman of the committee in charge of the event. At the Jovian luncheon held at the Hotel Bingham Dec. 4 Statesman George L. Thompson was scheduled to deliver a talk on "How to Finance a Large Corporation."

* * *

Southern California Jovians.—All records for attendance at the meetings of the Jovian Electrical League of Southern California were broken Dec. 3, when 120 members assembled at Christopher's, Los Angeles, and enjoyed an entertainment program of vaudeville acts. At the annual election in November the league elected the following officers: Chairman, Mr. J. N. Colkitt; vice-chairman, Mr. T. E. Burger; secretary-treasurer, Mr. K. E. Van Kuran, and executive committee, Messrs. J. G. Pomeroy and J. H. Pieper.

* * *

New York Jovian League.—At a meeting of the Jovian Order in New York on Dec. 10 Statesman C. L. Hight announced that a movement is under way to organize a New York Jovian League to be conducted under the auspices of the Jovian Order. The executive committee of the league will be made up of the chairmen of the various local committees of the Jovian Order. Tentative plans and a constitution will be submitted for discussion at a later meeting. The chief speaker at the meeting was Dr. C. B. Meding, who took as his subject the effect of eyesight upon character. Hereafter meetings will be held on Wednesday of each week at the Hotel Martinique.

* * *

New York Companies' Section, N. E. L. A.—The New York Companies' Section of the National Electric Light Association will hold a meeting on Dec. 15 at the Edison Auditorium, 44 West Twenty-seventh Street. Two papers will be presented, one on "Personal Initiative Within Corporate Enterprise," by Mr. J. W. Eaton, of the New York Edison Company, and another on "Instrument Maintenance," by Mr. S. E. Boyland, also of the Edison company. Arrangements have been made for presenting several reels of moving pictures of special interest to the electrical industry. Mr. F. C. Henderschott, 124 West Forty-second Street, New York, is executive secretary of the New York Companies' Section.

* * *

Commonwealth Edison Company Section of N. E. L. A.—The first 1913-1914 "get-together" meeting of the Commonwealth Edison Company Section of the National Electric Light Association, held Dec. 2 in the Insurance Exchange, Chicago, was an altogether successful affair. There were no speeches and no formality, but good fellowship was expressed by singing, cheering and social intercourse. The company orchestra furnished instrumental music and refreshments were served. The attendance was very large, about 1100 men being present. The next meeting of the section will be held on the evening of Dec. 16 in the Hotel Sherman. Mr. F. S. Peabody, of Chicago, the well-known coal operator, will give a talk on "Coal Mining," illustrated by motion pictures.

* * *

Meeting of Yonkers Division of New York Companies' Section, N. E. L. A.—The second monthly meeting of the Yonkers Division, New York Companies' Section, N. E. L. A., was held on Dec. 8 at the station of the Yonkers Electric Light & Power Company, Mr. G. B. Cornell, Jr., chairman, presiding. Mr. Edward J. Reilly read a paper entitled "The Corporation and the Man." Miss Mary A. Naylor gave an interesting talk on "The Electric Iron in the Home," and Mr. H. J. Otto addressed the members on the subject of voltage regulation of alternating-current feeder circuits, illustrating his remarks with lantern slides. Mr. Leslie Sutherland, general manager and vice-president of the Yonkers Railroad Company, also spoke. It was decided to hold a "ladies' night" either in January or February.

* * *

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on Dec. 4 officers were elected for the year 1914, the men chosen by the nominating committee being selected. On the evening of Jan. 8 there will be a "get-together" meeting at which the new administration, headed by Mr. Alfred R. Bone, commercial superintendent of the Chicago Telephone Company, will take charge. A gold watch fob was presented to Mr. George C. Keech, the president now in office. Mr. Bone, the new president, and the other newly elected officers spoke briefly. Mr. A. A. Gray gave an address on "Developments in the Electrical Field During the Year." He spoke of the commercial aspects of the industry, the consolidation of electrical properties, the increase in number of regulatory commissions, the notable accomplishments of the year in an electrical sense, the output of electrical energy in Chicago, the improvement in the out-door type of transformers, and the technical developments in electric lighting. Mr. Gray made the assertion that there has been a 26 per cent increase, approximately, in the value of the output of the electrical industries during the year 1913. He said, however, that owing to price shrinkage this represented a 35 per cent increase in volume of output.

The Central Station Idea in German Silesia

Mines, mills, factories, railways and general lighting service supplied from modern steam stations—Underground transmission at 6000 volts—Use of 20,000-kva turbines

SILESIA from a historical standpoint has long been one of the most interesting districts of eastern Europe, and now again the modern German province of the same name is attracting a measure of attention quite disproportionate to its mere physical size. The cause this time lies in its recent rapid electrical development, for within the borders of this mountainous section some very interesting experiments are being worked out in the application of central-station energy to industrial uses.

One of the most extensive of these central-station systems is the network of the Silesian Gas & Electric Company, whose headquarters are at Breslau. This company supplies service for lighting and motor drive over a large region in Upper Silesia, which is the mountain district, and operates two generating plants, located at Chorzow and Zaborze, having a combined rating of nearly 8000 hp. These stations, situated within 7 miles of each other, operate in parallel and form the center of the underground distribution system which covers the whole industrial region of Upper Silesia.

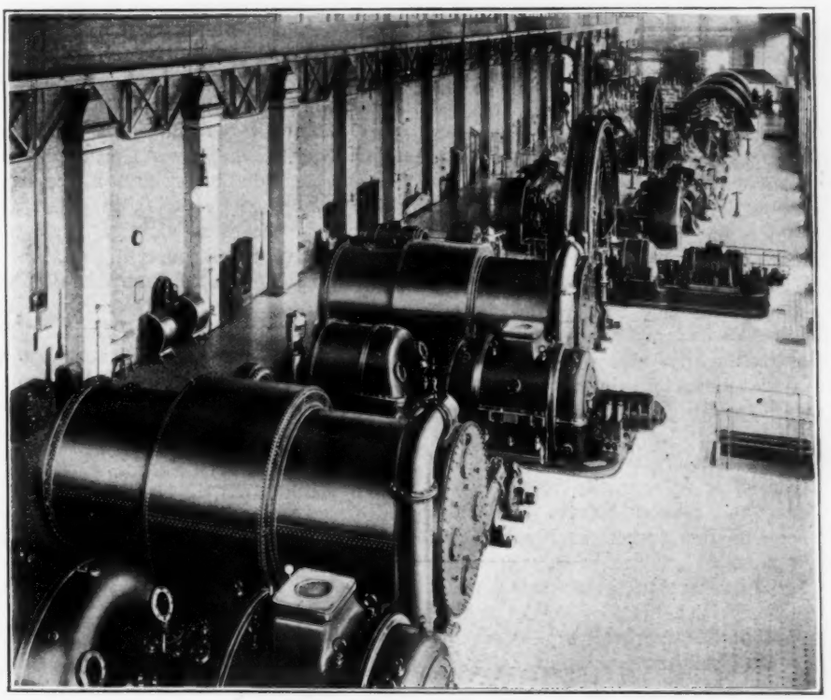


FIG. 1—THE CHORZOW CENTRAL STATION OF THE SILESIAN GAS & ELECTRIC COMPANY, UPPER SILESIA, GERMANY

Begun on a small scale in 1897, the Chorzow and Zaborze plants have undergone frequent additions until their present rating is many times the initial capacity. The first units installed were 400-hp engines, although later 1000-hp, 2000-hp and finally even 4000-hp reciprocating sets were added. In recent years turbine equipment has been installed exclusively, although the earlier engine sets still remain intact. In the foreground of Fig. 1 are seen some of the Chorzow steam-turbine units with the cylindrical shells of their surface condensers mounted on the same engine-room level. At the rear a number of earlier engine-driven alternators are shown. To-day the Chorzow station has a total rating of 40,000 kw and the Zaborze plant one of 25,000 kw.

The last prime-mover set to be installed at Chorzow was a 20,000-kva turbo-alternator of the horizontal type built by the Allgemeine Elektricitäts Gesellschaft. At 80 per cent power-factor this machine is rated for an output of 16,000 kw. The rotor, which runs at 1000 r.p.m., weighs approximately 50 tons. Blowers deliver 70,000 cu. ft. of filtered air through the generator parts each minute.

Steam is admitted to the turbine through eight valves, the first of which is set to pass quantities up to an amount corresponding to 5000 kw of load. The next six valves admit 2000 kw each, and the last valve, used principally during overloads, is designed to pass 4000 kw. Exhaust from this 20,000-kva turbine is received by two condensers each of which has a cooling surface of 64,500 sq. ft. Normally the condensers are connected in parallel. During the coming year a second 20,000-kw turbo-set will be added to the equipment of this station.

Attention is also directed to the very modern and well-designed switching equipment which characterizes the Chorzow installation. For example, the cells inclosing the oil switches are closed with iron doors. In case of fire or explosion of one switch the burning oil is prevented from spreading the fire to neighboring cells and thus extending the damage. Three triple-pole oil switches, arranged in parallel, serve to connect the large turbo-generator. Each of these switches is capable of rupturing the full-load current, so that in case of injury to any one of the trio operation can be continued with the others. Another interesting feature of these Silesian power plants is the extensive use made of reinforced concrete for many and varied purposes, some of which are quite foreign to the usual applications of this serviceable material.

From the viewpoint of American practice, doubtless, the feature of chief interest in connection with the Upper Silesian system is the scheme of distribution by means of 6000-volt underground cables. The 6000-volt, 50-cycle, three-phase output of the alternators is transmitted directly at its generated pressure and is reduced to the desired secondary voltage by transformers installed at the points of consumption. In the case of a number of industrial installations, 6000-volt motors are employed operating directly on the line without step-down transformers. These high-

tension primary motors are used chiefly in the service of rolling mills, blast furnaces, mines, etc. For lighting in the towns and cities included in the company's territory 120 volts and 240 volts have been selected as the standard secondary pressure.

At the present time the Silesian company's central stations are also supplying direct current for operating the

FIG. 2—MOTOR DRIVE IN ROLLING MILL AT JULIENHÜTTE, GERMANY

greater part of the Silesian narrow-gage railway. Later three-phase, 6000-volt alternating current will be purchased from the system for transmission to substations along the railroad's right-of-way. In these substations the alternating-current supply will be converted into 600-volt direct current for energizing the trolley.

Aggressive new-business methods have characterized the policies of the Silesian Gas & Electric Company, and as the result of this progressive attitude in the making of rates when disposing of energy in large quanities the central station now includes on its lines many of the largest manufacturing plants in this important industrial region. Already, indeed, a strong disposition exists to use central-station service extensively in the mining and metallurgical fields wherever possible. Practically all of the newer installations and works use electric drive exclusively.

In the field of residence and smaller commercial business the company has been no less successful through its institution of reasonable rates of advantage to the small consumer. Although the high-tension lines are placed underground throughout the district, most of the low-voltage distribution circuits are of the overhead type common in this country. Tables reproduced herewith show the con-

TABLE I—CONNECTED LOAD OF SILESIAN GAS & ELECTRIC COMPANY SYSTEM

Year	Customers' Lighting, Kw	Street Lighting, Kw	Industrial, Kw	Total, Kw
1909.....	8,282	262	13,719	22,287
1910.....	8,910	321	16,710	25,941
1911.....	10,651	316	20,682	31,649
1912.....	10,980	323	34,152	45,455

nected load and kilowatt-hour consumption of the system during the last four years, as divided among various classes of customers.

During 1912 the Silesian company's system output was 126,000,000 kw-hr., with a maximum load of 41,600 kw.

In Fig. 2 is shown an electrical installation of considerable interest recently completed at the Julienhütte iron works, at Gleiwitz, in Upper Silesia. It is one of the numerous plants of its kind in this district in which electric motors supply practically all the power. In the background of the illustration are seen the direct-current reversible motors for driving the mill rolls. These motors are of the Allgemeine-Ilgner type. At the right is a group of machines making up a pair of Ilgner motor-generator sets

TABLE II—ENERGY CONSUMPTION OF SILESIAN SYSTEM IN THOUSANDS OF KILOWATT-HOURS

Year	Customers' Lighting	Street Lighting	Industrial	Street Railway	Total
1909.....	14,639	937	52,184	4,326	72,08
1910.....	11,183	1,063	67,661	4,135	84,042
1911.....	12,372	1,105	80,686	5,918	100,081
1912.....	14,328	1,187	103,097	7,627	126,240

which take three-phase, 6000-volt alternating current from the supply mains and furnish direct current for the rolling-mill motors above mentioned. The equipment is assembled in two similar halves, each composed of a three-phase motor coupled to a direct-current generator, with a 28-ton flywheel mounted on each connecting shaft. The two halves can be operated separately or together, depending upon the needs of the mill. Normally, however, the two generators are coupled in series and supply current to the two rolling-mill motors (each rated at 1800 hp), which are also connected in series. Other examples of the use of large motors for rolling-mill work are the three Allgemeine 2000-hp direct-current motors installed in the Bismarckhütte tube mills, and a set of six 2500-hp three-phase motors in operation in a large structural-iron rolling mill in the same vicinity.

Another of the large central-station networks in Silesia is operated by a local enterprise known as the Provincial Union, whose lines supply such centers of distribution as Lauban, Greiffenberg and Haynau. The shorter lines, as a general rule, are operated at 10,000 volts, while the circuits supplying Löwenberg and Haynau operate at 30,000 volts. At each of these centers transforming and switching substations are located near the city limits. The prac-

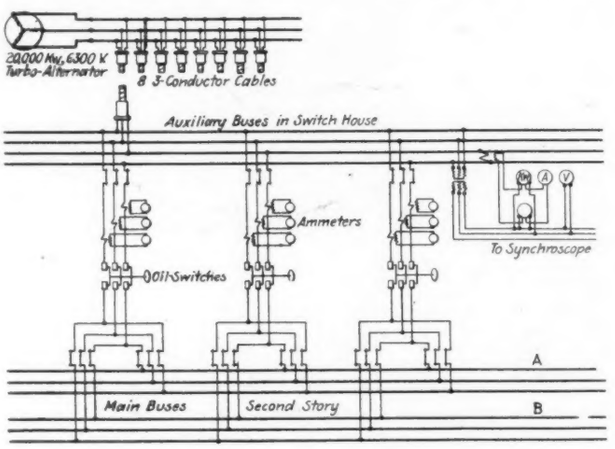


FIG. 3—ARRANGEMENT OF BUS CONNECTIONS FOR 20,000-KW TURBO-ALTERNATOR

tice has been to run the high-tension lines in closed loops, each of which includes a certain number of localities.

The total length of high-tension lines of this system is now about 400 miles, and the company is operating at the present time in the five cantons of Lauban, Löwenberg, Hirschberg, Bunzlau, Goldberg-Haynau and Schönau, with a total population of 365,000.

Municipal Electrical Enterprise in England

A discussion of the relative merits of municipal and private operation of electrical supply undertakings in England. By A Briton

FOR years it has been the practice of the English government to set apart enterprises which municipalities are free to carry on for the benefit of the community. "Municipal trading," as it is compendiously called, has thus become a feature of English life, and among the industries which have been much favored by the attention of town councils and other local bodies electric lighting and traction are by no means the least prominent. It is safe to say that in most English towns where electricity is used for lighting the plant is run by the borough council or corporation, while so far as traction is concerned most of the electric railways are in the hands of local authorities.

The reasons and arguments which led the English government to favor municipal as against private control are comparatively simple. It was thought that as cheap light and traction are essential to the well-being of every citizen there should be no monopoly in their use, and that whatever profit should be made ought to be devoted to the reduction of local taxes and not to the enrichment of individuals. Thus when a large profit was made on the year's operation of a municipal electrical undertaking it was thought that the money could be used to reduce the taxes or to reduce the price per kilowatt-hour or per ride.

To sum up the whole matter, a municipality goes into business under certain restrictions which are clearly and exhaustively defined by act of Parliament. If it has power to run electric railways on the overhead system, it cannot, without fresh authority from the English Parliament, adopt the underground system. If it finds the competition of motor buses exigent, it cannot scrap its plant and start business on new lines. Again, if an English corporation has power to supply electric light it cannot supply lighting fixtures without special dispensation. In these circumstances, hampered at every turn, it cannot make a profit; and unless a business can be run at a profit it is an elementary principle of political economy that it cannot be run at all.

When the craze for indulging the mania for reducing the taxes by municipal enterprise was at its height ten years ago, the various English technical papers did what they could to point out that the practice of reducing the taxes out of profits was financially unsound, unless adequate allowance was made for depreciation. At the time, of course, the warning fell upon deaf ears, but the school of experience has now taught a lesson which the technical journals wholly failed to inculcate. For a variety of reasons little notice has hitherto been taken of this most vital point, and it is only now that persons concerned with local government in England are beginning to find out that this is the rock upon which the ship of the municipal trader runs most chance of being wrecked. It is a rock which at the best of times is but faintly visible to the average borough councilor and is wholly concealed from the taxpayer. It is of no concern to the man who is elected a member of a corporation for a period of three years or less that ten years afterward the municipal enterprises which he has pledged himself to support will be hopelessly insolvent. By that time he will probably have withdrawn from the din of municipal politics. "Take no thought for to-morrow" is a maxim which appeals to the minds of the municipal politician. He is not, of course, to be greatly blamed. He is not paid for his services. In nine cases out of ten he has honestly given freely of his time and experience (such as it is) for the benefit of his fellow-citizens. It is not his fault that his services are worth no more than he was paid for them. It is the fault of the system under which unqualified persons are permitted to rush into various enterprises for which they have no experience and to spend capital drawn from the pockets of persons who are compelled by law to provide it, but to whom is given hardly any articulate voice in its disposition.

To point the moral, it is necessary only to refer to the English electric railway enterprise. It is now many years since it was strenuously urged by the politicians—municipal and other—that street locomotion of this type was eminently fitted to be controlled and owned by the taxpayers. As a result municipal electric railways are to be found in many parts of the country. In some places, no doubt, the railway is still, on paper, a self-supporting institution. If not making large sums of money, the town councilors in many cities are able to show a reasonable profit. But what about repairs and renewals? How large is the scrap heap at the tramway depot? What is the state of the track? Are the flanges of the wheels as good as they were?

The truth is, of course, that when a kind of limited monopoly was conferred upon the local authority that body, content generally with the magic word "monopoly," asked for—and got—nothing more. To take an illustration: When the London County Council obtained railway powers the motor bus was not thought of. Many—perhaps most—of those who held power in the County Council thought that the last word had been said in the solution of the problem of street traffic. It did not concern the Parliament of London that other vehicles might run in competition with their rolling stock. Events have proved that the views so held were fallacious and that the monopoly which was so proudly vaunted by the first local authority in England could now hardly be sold in the market.

There is one aspect of the failure of this form of municipal trading in London which appeals forcibly to those who, in their business as engineers, have often been harassed by the tax collector. The London County Council levies taxes with no sparing hand. And, strange to say, through the glaring imperfections of the English taxing system it cannot collect taxes on any adequate scale from the omnibus companies which cover the streets with their cars. Machinery in a factory or mill is for all practical purposes taxable, but a gasoline engine in a motor bus adds practically nothing to the taxes.

The result has been that in many parts of England people are coming to the conclusion that the best course for the municipal trader would be to acquire parliamentary power to sell out and thereby eliminate his loss. The private electric railway or lighting company, stimulated by certain restrictions as to minimum fares and meter rents, can do all that is required by the public. If the directors of a railway company find it is impossible to cope with the increasing needs of the public by railways alone, they are at liberty to supplement the service with motor buses. This is merely one example of the manner in which private enterprise can undertake what is practically impossible for municipal enterprise.

Varied Uses of Electricity in a Modern Hotel

Central-station service for lighting, motor drive, ventilation, water pumping, refrigeration and certain heating applications in the million-dollar Hotel Ohio at Youugstown, Ohio

INASMUCH as entire reliance on central-station electrical supply is still the exception rather than the rule in the case of hotels, the example of the new Hotel Ohio in Youngstown, Ohio, is interesting and instructive. This hostelry, which has just been opened, is very modern, and all energy for lighting, motor drive and some heating appliances is furnished by the electric-service company. In this respect the house ranks with the Hotel Sherman, of Chicago, and the Hotel Statler, of Cleveland.

Standing on the corner of Boardman and Hazel Streets in Youngstown, rather aside from the main current of street traffic, the Hotel Ohio has resorted to an extensive individual street-lighting installation in order to attract the traveling public to its doors. Youngstown boasts no "white-way" illumination, but the hotel's ornamental posts make Boardman Street one of the brightest thoroughfares in the city. In addition, therefore, to advertising the hotel this private lighting installation is thus of real value to the community.

The main portion of the hotel measures 156 ft. by 120 ft. and rises to a height of 127 ft. from basement to roof. A southeast wing of the building is but three stories high and measures 77 ft. by 107 ft.

In lighting, heating, ventilation, sanitation and safety the Hotel Ohio seems to represent the latest advances in hotel construction. The control of all of its various systems is centered in the switchboard room in the sub-basement, as shown in an accompanying illustration. The switchboard itself in the background consists of six marble panels, which, enumerated from left to right, carry the control apparatus for the alternating-current motor-service circuits on the first panel, the elevator circuits on the next three, the alternating-current lighting circuits on the next, while the last is a battery panel for controlling an emergency storage battery charged from a small motor-generator set in the switchboard room. The alternating-current service enters the building through an underground duct and is conducted directly to a bank of four 40-kw, 2200/220/110-volt transformers in a room back of the switchboard. The low-voltage taps are taken from these two-phase transformers to the alternating-current panels of the board.

The 9-in. by 14-in. ammonia pump serving the refrigerating system is shown in the center of the illustration. This unit is driven by a 40-hp Western Electric induction motor operating on a 220-volt circuit at 514 r.p.m. The ice plant of the hotel is capable of producing 25 tons of ice a day if forced to the limit of its capacity. Circulation of the brine is accomplished by two 5-hp, 220-volt Triumph induction

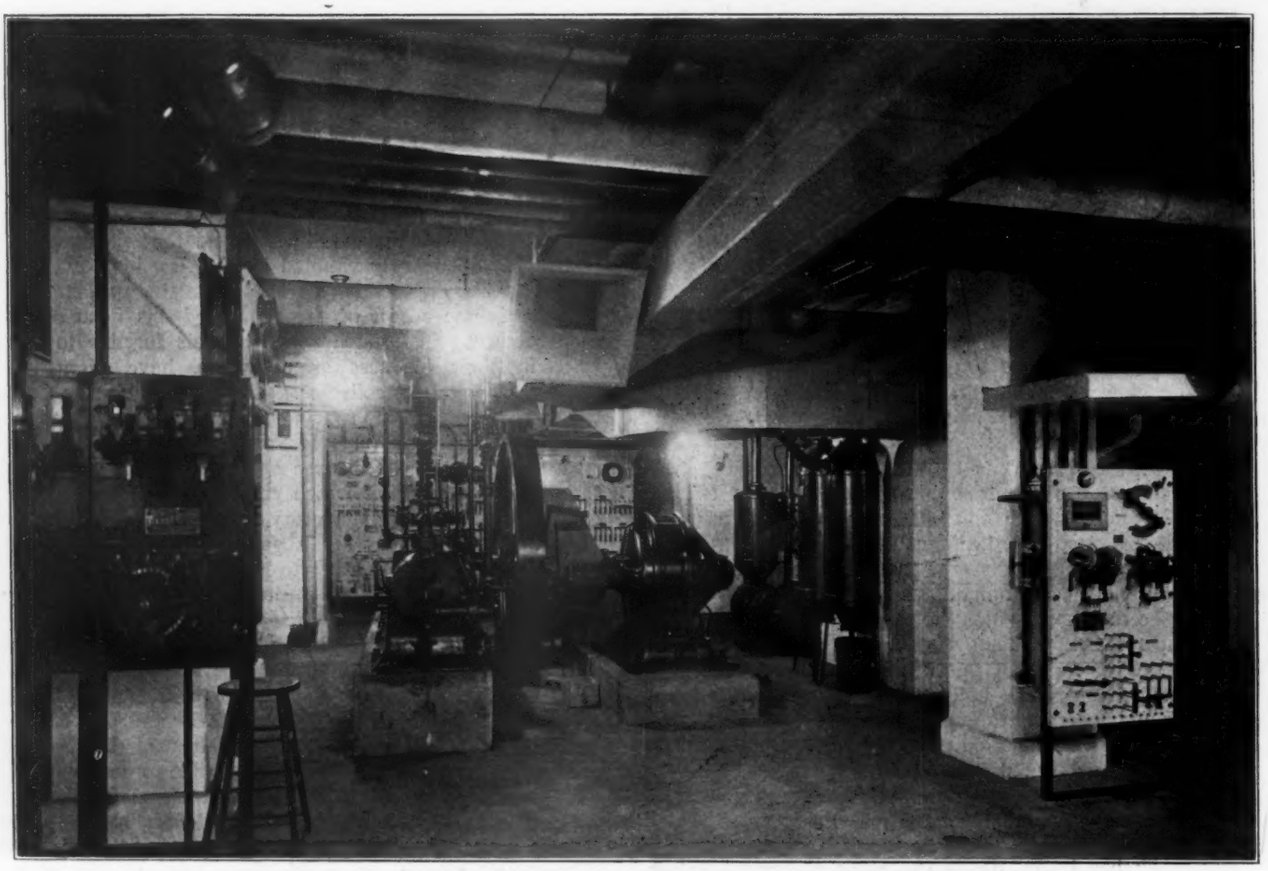


FIG. 1—MACHINERY AND SWITCHBOARD ROOM, HOTEL OHIO, YOUNGSTOWN

motors operating at 1720 r.p.m. A 3-hp induction motor belted to a countershaft is arranged to drive either an ice crusher or an ice saw for cubing the congealed liquid for use on the table.

The vacuum-cleaning system for the entire hotel is shown at the right of the compressor. This outfit, which was furnished by the McCrum-Howell Company, of New York City, is driven by a 10-hp, 220-volt induction motor operating at 1200 r.p.m.

HEATING, VENTILATION AND SANITATION

In an adjacent room have been placed two boilers supplying low-pressure steam for the steam tables, the laundry and the Van Auken heating system. Water for these boilers is supplied by two automatically operated 10-hp motor-driven boiler-feed pumps. One of these units is kept in reserve at all times. Both operate at 600 r.p.m. For the general water-supply system of the house a 75-hp Western Electric motor drives a 5-in. by 6-in. triplex pump lifting water to a tank on the roof of the building. To insure sanitation and to relieve the hotel of all waste water a 5-hp motor-driven pump has been installed to maintain a vacuum on all drainage lines leading from the building.

A motor-driven suction fan in the roof takes in fresh air from above the surrounding buildings and delivers it to an

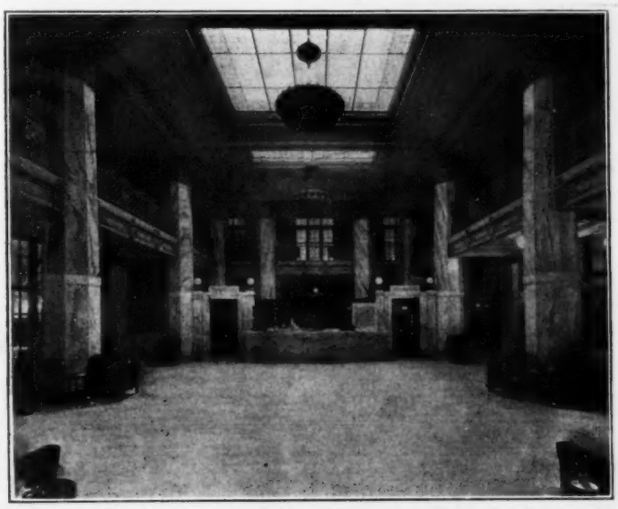


FIG. 2—LIGHTING UNITS IN LOBBY AND ABOUT CLERK'S DESK

air washer for purification. The washer is capable of cleansing 28,600 cu. ft. of air a minute, and this amount it is said will change all of the air in the principal rooms of the hotel at the rate of once a minute. The air is heated to the desired temperature as it is passed through the washer. Burglar alarms and fire alarms are installed in the halls on every floor of the building.

ELECTRIC SERVICE IN LAUNDRY AND KITCHEN

The laundry is equipped with electric drive throughout. In the background of the illustration showing this department may be seen the three large automatically reversing motor-driven tubs in which the linen of the hotel is washed. The tubs are driven by individual 3-hp General electric motors which are reversed by contactors mounted on a group of panels within the wire cage at the right of the tubs. Two centrifugal driers driven by 3-hp induction motors operating at 1200 r.p.m. remove the water from the wet linen as it is brought from the tubs. An automatic safety device on these driers prevents starting while the lid is raised. The big Troy five-roll mangle in the foreground, used for finishing all flat pieces, is driven by a 2-hp General Electric induction motor operating at 900 r.p.m.

In the kitchen liberal use is also made of central-station energy, for there the dishes are washed in a motor-driven washer, ice-cream freezers are electrically operated, and a small motor-driven buffer is used for polishing the silver.

LIGHTING

The general lighting of the main lobby is furnished by two large ornamental units suspended from the ceiling by chains. Each of these fixtures carries sixteen 60-watt tung-

FIG. 3—MOTOR-DRIVEN MACHINERY IN LAUNDRY

sten lamps with frosted bulbs. Auxiliary illumination is supplied by the tungsten units suspended in diffusing bowls in the center of each bay under the mezzanine floor. Four upright standards illuminate the clerk's desk. The lobby is finished in Canadian marble and the natural warmth of the predominating gold and cream blend with the yellow of the tungsten lamps to take away the sense of coldness often present where marble is used extensively.

Figs. 4 and 5 show two representative types of lighting used in the five dining-rooms of the hotel. The main dining-room (Fig. 4) has been finished in a dignified French gray and trimmed with gold. Mirrors about the sides of the room reflect images of the clusters of frosted lamps and

FIG. 4—LIGHTING OF MAIN DINING-ROOM

add to the effective illumination. The hanging lanterns shown in the rathskeller, Fig. 5, harmonize with the Old North style which has been followed in this room, and the light from their yellow panels lends a warm glow to the surroundings.

The guests' rooms, of which there are 217, are each equipped with a 110-volt electric ceiling fan and adequate

lighting equipment. A representative bedchamber is shown in Fig. 6. A single 60-watt tungsten lamp in a Holophane reflector, suspended over the foot of the African-mahogany bed, provides the general illumination for the room. Smaller shaded lamps over the dressing tables are installed for local illumination. Additional flush-plug receptacles are

FIG. 5—HANGING LANTERNS IN RATHSKELLER

installed near the dressing tables for the convenience of the woman who uses an electric curling iron. Telephone service is provided in each room.

For the service of the guests two Otis elevators operating from the 500-volt direct-current circuits of the central-station company ply between the main floor and the eighth. Those portions of the hotel frequented by the hotel employees are designed so that it is unnecessary for the servants to enter the guests' quarters except for cleaning. Three motor-driven elevators in the rear of the building are for the use of the servants exclusively in traversing the distance from the machinery room in the sub-basement to the electrically operated laundry on the third floor.

The construction and equipment of the Ohio Hotel cost

FIG. 6—TYPICAL GUEST'S CHAMBER, HOTEL OHIO

approximately $1,000,000, and the ownership is purely local, being vested in a stock company known as the Youngstown Hotel Company, of which Mr. J. G. Butler, Jr., is president. Mr. C. T. Alexander is manager of the hotel. The energy for driving all electrical apparatus in the establishment is purchased from the Youngstown Consolidated Gas & Electric Company.

Transmission-Line Service to Central Kentucky Towns

Several small towns and rural districts in Kentucky which have never before enjoyed the conveniences of electric service are now being supplied with energy from the transmission lines of the Kentucky Utilities Company, which has its main offices at Lexington. This company is a subsidiary of the Middle West Utilities Company, of Chicago, and is following the example of the parent corporation in furnishing electric service to towns which have never before had it, in a number of cases operating small plants twenty-four hours a day. At present the company supplies energy to seventeen towns, some of which have their individual generating stations, while others are fed over transmission lines from central points. Generating plants are located at Shelbyville, Richmond, Winchester, Elizabethtown, Somerset, Middlesboro and Pineville.

Some electricity is being purchased from the Lexington Utilities Company and is transmitted at 33,000 volts to Versailles, from which it is distributed to several small towns in the surrounding territory. Several large distilleries are located in these places, which never had electricity before. At Tyrone the Kentucky River Sand & Gravel Company operates the largest rock crusher in the

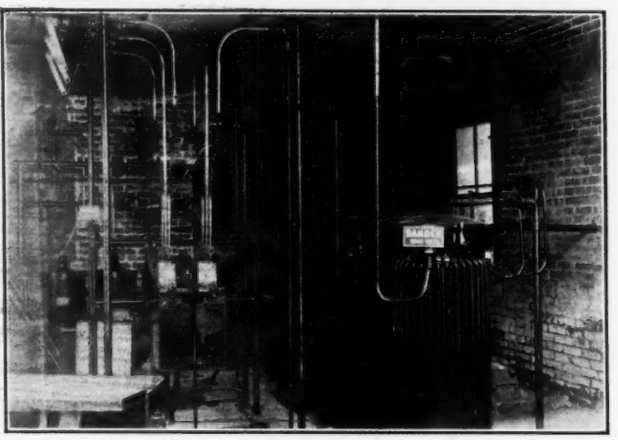


FIG. 1—INTERIOR OF HIGH-TENSION ROOM AT SHELBYVILLE

State. This plant was formerly run by steam, but is now driven by electricity. The old generating plant at Lawrenceburg, another town on the line, will be shut down shortly.

A new 100-kw generating station has been completed at Shelbyville, and an 11,000-volt transmission line has been built from that place to Eminence, a distance of about 14 miles. Three towns are fed from the latter plant, and in each of these places contracts have been closed for street series incandescent-lamp lighting.

Down in the southeastern part of the State, in the town of Middlesboro, is a 150-kw generating station which supplies its entire output to coal mines in the vicinity. A generating station which supplies energy for similar purposes is situated at Pineville.

The largest separate generating plant opened by the company up to the present time is being built at Somerset. This station will have a rating of 200 kw and will furnish energy to Somerset and to Burnside, a town about 8 miles to the south. The Kentucky Utilities Company is also contemplating the erection of a large station at Winchester which will be used to feed the town of Mount Sterling as well. Elizabethtown has a new generating plant which is about completed and will furnish twenty-four-hour service to the community. A contract has been secured in that town for pumping the city water, and a 20-hp pump has been installed which will supply 1,000,000 gal. of water

per day. Contracts for supplying energy to motors having a total rating of 60 hp have also been closed. In addition to the industries mentioned, others to be supplied with energy by the Kentucky Utilities Company are lumber mills, cotton mills, motor works and mines. In four of the towns water is pumped, in three ice plants are operated, and in

FIG. 2—EMINENCE GENERATING PLANT USED AS SUBSTATION

Shelbyville and Somerset gas plants and street-railway systems are managed in conjunction.

Most of the transmission lines connecting the central generating stations with the smaller outlying towns are 11,000-volt, three-phase, 60-cycle circuits. Where a rural community desires service the line is constructed at its expense and 25 per cent of each consumer's monthly bill is refunded as payment on the amount expended for line construction. As the project progresses attempts are being made to standardize the rates. The form of contract used by the Commonwealth Edison Company of Chicago is being used wherever business agreements are entered into.

In each town in which the company operates it has opened up a small electric appliance office which is superintended by the agent in charge of that district. On the day before the opening of such an appliance office, advertisements are published in the local newspapers informing the people of the new service and announcing prizes which will be given away on a certain date. Each person expecting to draw a prize is expected to fill out a coupon which accompanies the advertisement. Several questions are asked

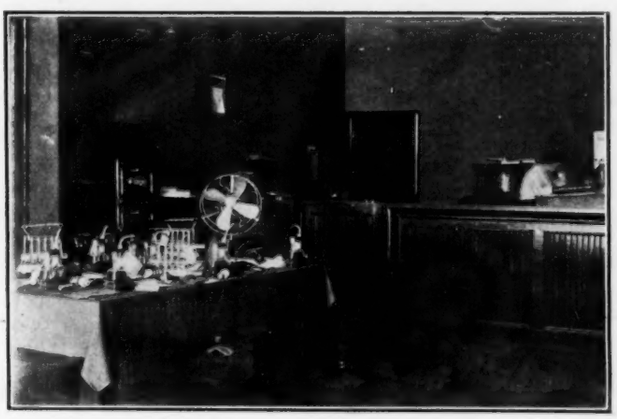


FIG. 3—APPLIANCE ROOM AND OFFICE AT SHELBYVILLE, KY.

on these coupons which furnish valuable data when the time arrives to solicit contracts.

Very few of the plants which were purchased by the Kentucky Utilities Company had offices which were pleasant for a woman to reach. The new appliance-sale offices which have since been instituted have therefore proved very attractive to the women and make the new electric service a much-talked-of subject in the towns. To earn the good will of the people, advertisements have appeared in the newspapers offering, upon request of a physician, to furnish free electric-fan service to any patient who is unable to pay for such a convenience.

Pole-top substations are used in several of the towns which are supplied with energy from a transmission line running through them. Transformers, disconnecting switches, regulators and Anderson time switches are installed on many of these substations. Where street lighting is furnished arrangements are made with town marshals in many cases to wind up the clocks on the time switches. All of the towns in a certain district are under the supervision of a district agent, who has an automobile so that he can go around and inspect the different installations periodically. The agent is often responsible for the reading of meters and the collection of bills. About once a month the district superintendents meet at the main office of the Kentucky Utilities Company in Lexington, where they discuss operation, maintenance and the securing of new business.

The officers of the company are: President, Mr. Martin J. Insull, Chicago, and vice-president, Mr. Harry Reid, Lexington, Ky. Mr. C. J. Eaton, Lexington, is manager of

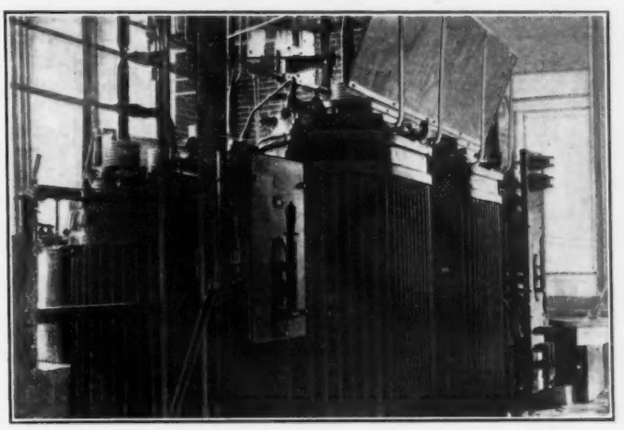


FIG. 4—TRANSFORMERS IN VERSAILLES SUBSTATION

the commercial department, and Mr. C. C. Hyde, Chicago, is supervisor of construction.

Electricity at $111 per Kw-hr.

The central-station customer who thinks he is paying a high rate for his electricity might with profit follow the calculations sent us by a correspondent who has figured $111 per kw-hr. to be the cost of the energy consumed in the average pocket flash-lamp. Such a flash-lamp is sold at 50 cents, while a renewal of the three miniature dry cells usually costs 25 cents. The little filament takes about 0.25 amp, and the battery supplies 3 volts. Used daily such a battery will be found to be exhausted in, say, two months, or after a total of 180 minutes or three hours' operation. The output of the cells has therefore been 3 volts $\times$ 0.25 amp $\times$ 3 hours, which equals 2.25 watt-hours. At this rate of 25 cents for 2.25 watt-hours, the cost of a kilowatt-hour would be 11,100 cents, or $111—which is more than a thousand times the average rate paid for central-station electricity.

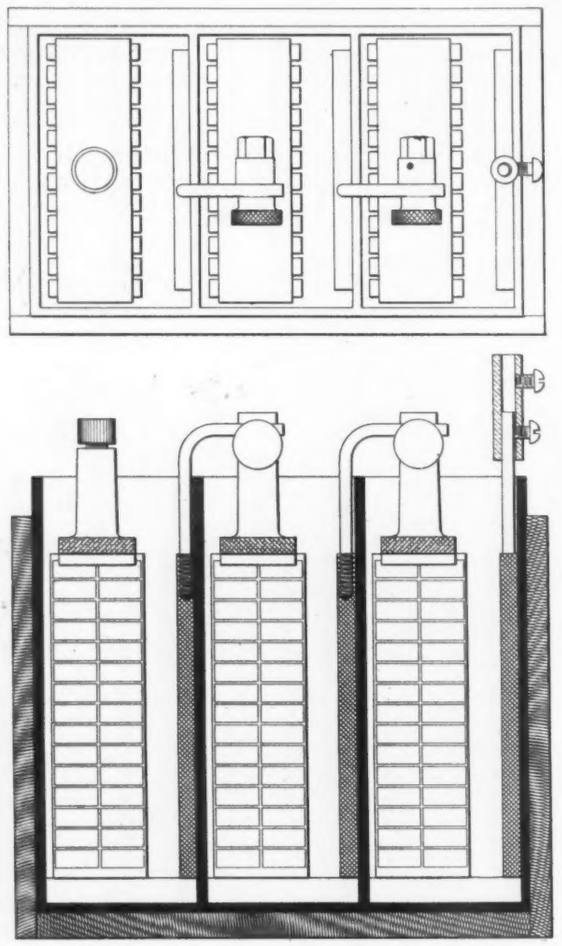
Applying the same scheme of careful calculation to the service performance of a pair of dry cells used for door-bell ringing, an even higher cost per kilowatt-hour will be obtained, for here the draft of current taken from the battery is smaller while the extremely short periods of use result in a distressingly low "load-factor."

Battery for Experimental Use

By Harry E. Dey

Many engineers, draftsmen, machinists and others scientifically inclined have felt the need of a battery that could rest on the shelf for periods of six months or a year and yet, when the occasion arose, would be ready for immediate use. Primary cells of the removable-zinc type do not have high enough discharge rates, besides exhausting very quickly. Those of the sal-ammoniac family also display too low outputs. Dry batteries run down on the shelf, while neither their capacity nor their discharge rates are up to the requirements. The lead-storage cell, while meeting all the other conditions, will not retain its charge for any long period and goes to rack and ruin if not kept charged.

For his own convenience, therefore, the writer, finally



PLUNGE-TYPE BATTERY FOR EXPERIMENTAL USE

solved as follows the problem of obtaining a cell of the desired characteristics:

A hard-rubber jar divided by two partitions into three compartments, each measuring 2.25 in. by 4 in. by 6.25 in. deep, was purchased. This container provided space for three cells. Next six storage-battery positive plates of the lead type were obtained and cut crosswise into strips 1.375 in. wide by 4.75 in. long, the latter figure being the original width of the plate.

After scraping one end of each plate and its adjacent edges, the plates were grouped into sets of twelve, placing together their flat sides separated by a 0.0625-in. sheet of wood, completely filling the space. Berry boxes furnished this spacing material. The plates are tied together with twine, while a wall was built up around the cleaned end with plaster of paris. A standard pillar-post connector was then set in the center of the basin thus formed. After giving all the cleaned surfaces a liberal sprinkling with resin, the space within the walls was filled with melted lead that had been heated to the point of redness. A lead-burning outfit would have been preferable, but with proper judgment and care the pouring of overheated lead makes a fairly good substitute.

By thus joining together the twelve small segments (comprising two standard plates) a thick plate, 3.75 in. wide by 4.75 in. deep and 1.375 in. thick, was produced. The wood separators were then removed and the plaster carefully washed off, leaving the spaces between the sections open for circulation of the electrolyte. While this design is not precisely ideal for extremely high discharge rates, it will nevertheless take care of 100 amp to 200 amp for short periods. Three of these thick plates were made, one to serve as the positive electrode in each compartment. For the negative plates 0.25-in. rolled zinc was purchased from an electrical supply house and cut into plates approximating 3.5 in. by 4.75 in. in size. At one end these were drilled and tapped to receive copper rods about 0.1875 in. in diameter, to serve as terminals. Two of these rods are bent at right angles, reaching over to be clamped by the pillar-post thumb-nuts on the positive plate in the adjacent compartment, while the one on the end plate remains straight. This arrangement provides a quick and convenient method for making connections, for the zincs are to be removed whenever the battery is not in use.

The zinc plates were amalgamated by being dipped into the electrolyte and then being rubbed with mercury. The electrolyte is a mixture of one part sulphuric acid with three to four parts of water. The regular lead-battery electrolyte, although slightly stronger, will answer the purpose very well, for a wide range in strength of the solution is permissible. When mixing the acid and water, pour the acid slowly into the water, stirring continuously. Never pour the water into the acid, or the results may be disastrous to eyesight, good looks and clothing. Use a stone or porcelain vessel as the receptacle during mixing, for glass is liable to crack, owing to the heat generated.

This battery had a rating of about 60 amp-hr., with an emf of 7.5 volts. The extra 1.5 volts over the emf produced by the same number of lead cells is due to the zinc, which gives an extra half volt per couple.

The battery, including the outside wood case, weighs about 25 lb. When the zincs are consumed they have, of course, to be replaced with new ones. As a pound of zinc will give over 200 amp-hr., this item is negligible.

The battery is used in the same manner as any plunge cell of the primary type. It is, in fact, a sort of compromise between a primary and secondary battery. When not in use the zincs are to be removed and then absolutely no action can take place; meanwhile the lead positives may remain in the electrolyte, being unaffected thereby. The writer's battery has stood for periods of fifteen months between charges, and although it had in the meantime been used many times for operating a spark coil and running a motor drawing sometimes 20 amp to 30 amp, it still contained apparently plenty of life at the end of this period. The battery is now two and a half years old and has been charged only twice, in addition to the original charge. It is now apparently ready for any emergency, judging from a recent test, although about eight months have elapsed since it was last charged. There is probably no limit to the time that such a cell can be kept upon the shelf and still be ready for work as soon as the zincs are immersed.

While the construction described provides a very compact battery, a good substitute (and probably an easier construction) would be to use two full-sized standard lead positives, with a zinc plate removably placed between them as commonly used in the Grenet type of bichromate-of-potash plunge battery. Such a battery could be made up in compartment or individual cells as desired. Such construction, however, would have the objection that only one face of the

positives would discharge, which, besides lessening the capacity, might cause buckling.

When recharging, the zincs may be left in the cells and the zinc will go from the solution back to the plates. The cycle, however, will be incomplete, for a considerable quantity of the zinc will remain in the electrolyte. For this reason it is good practice, if the best results are desired, to replace the electrolyte with a new solution after charging the battery.

Electric Coal Mining in Central Illinois

The O'Gara coal mine in Sangamon County, Ill., has now been operating with electric drive exclusively for several months. From 800 to 1000 tons of coal is being produced daily at an average cost of $400 per month for electrical energy, according to data obtained from the Springfield Light, Heat & Power Company, of Springfield, Ill., which furnishes the electricity. According to this figure, the mining company is operating at approximately the cost of its former coal bill, without the attendant inconveniences met with in the winter from heat radiation and freezing of water, besides avoiding the additional labor required with steam operation.

Electrical operation of the mine has eliminated the use of mules, horses, coal, waste, packing and firemen. Water obtained in this district is unsuitable for boiler feed except when treated with some boiler compound. The two major

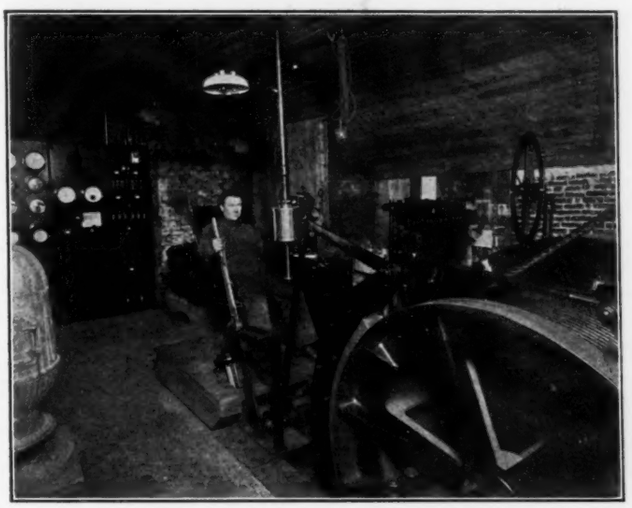


FIG. 1—HOISTING ROOM, SHOWING SWITCHBOARD AND CAGE HOIST

advantages of electrical drive in this instance are the elimination of heat radiation from steam pipes and the fact of doing away with the use of mules. To care for a mule costs 75 cents a day, and the wages of the drivers are $2.83 a day.

Some coal-mining companies in Sangamon County have been backward about installing electric drive, as it requires an outlay which they were not certain was warranted by the results. To meet this argument the local electric-service company agrees to install the apparatus, the payments on which are made on instalments. The electric-service company in Springfield estimates that a 1000-ton mine in Illinois can be equipped above and below ground for electric service for about $15,000. This includes the cost of installing, rebuilding, bonding rails and running trolley wires for locomotives. It is stated that the equipment will pay for itself in four years whether the mine is operating or not. Electric service shows its greatest saving over steam operation when the mine is not running. This is a considerable item where strikes are prevalent and the mine is shut down, as the gases and water have to be kept out of the mine whether it is in operation or not. The additional advantage of being able to increase the output of a mine without replacing apparatus or making numerous changes in pipe lines should not be overlooked in any estimate of the merits of electric service.

The rate earned is determined by the maximum demand and the energy consumption. As two voltages are used in

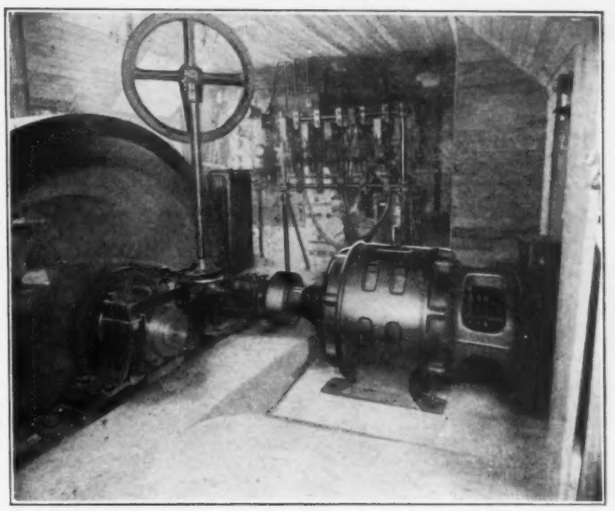


FIG. 2—HOISTING MOTOR IN O'GARA COAL MINES

the mine, separate printometers are employed to record the consumption of energy. From the records kept since the installation of electric drive, about 1 kw-hr. of energy has been consumed per ton of coal mined.

Electrical energy is delivered to the O'Gara mine over a 6600-volt, three-phase transmission line. The connected motor load aggregates 405 hp. All of the wiring is run through conduit to the point where it is delivered to the various motors.

Contrary to the situation encountered in Eastern coal mines, the mines in Illinois are fairly dry and practically

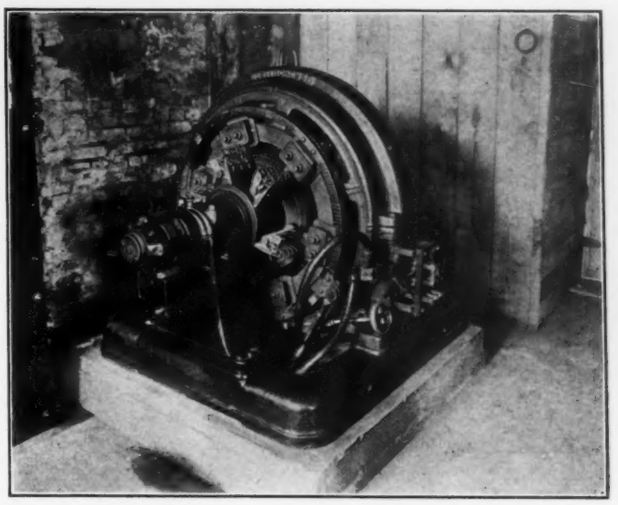


FIG. 3—ROTARY CONVERTER SUPPLYING ENERGY TO MINE LOCOMOTIVE

devoid of dangerous gases. Faults in the structure of the earth are prevalent, however, and the shafts are lined with concrete to prevent slides. The interest on the investment for constructing such shoring and benching in the different levels counterbalances the cost of pumping in wet mines.

Two vertical shafts are installed in the O'Gara mine at

present—one for delivering fresh air to the mine and the other for the removal of coal. Each shaft is provided with a 216-cu. ft. sump pit for collecting the small amount of water which seeps into the mine each day. Both sumps are emptied by a single automatic electric pump, which is required to be operated only about one hour each day. The apparatus used for emptying the sumps consists of a two-

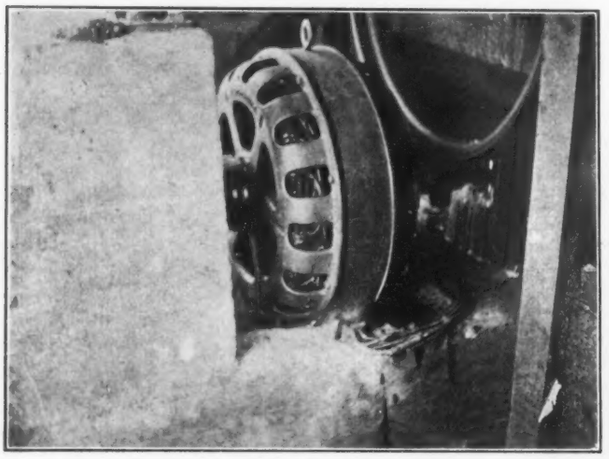


FIG. 4—VENTILATING-FAN MOTOR INSTALLED IN O'GARA COAL MINE

stage, horizontal, centrifugal pump, direct-connected to a 220-volt, three-phase Westinghouse squirrel-cage motor. Operating at 1700 r.p.m., the pump is capable of delivering 50 gal. per minute.

In this Illinois field coal is obtained from strata about 200 ft. to 300 ft. deep. In this particular mine the coal is lifted a total distance of 300 ft. The old steam-operated cage hoist formerly used has been replaced by an electrically driven Lidgerwood hoist. A maximum rope speed of 800 ft. per minute is obtainable on this hoist, and a round trip is completed in thirty seconds. Eight seconds is required for accelerating the car to full rope speed; eleven seconds

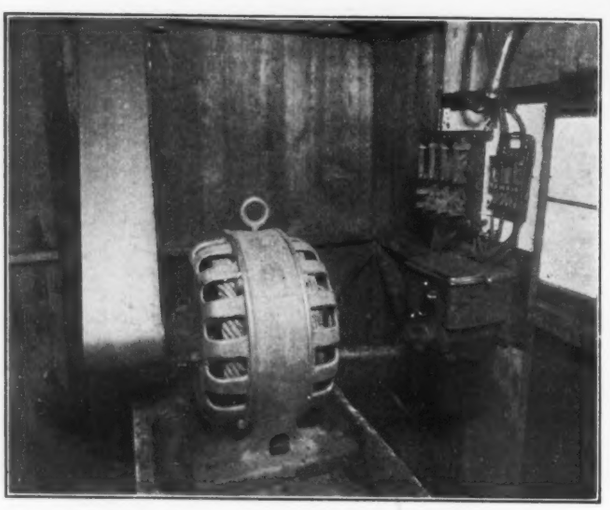


FIG. 5—ELECTRIC MOTOR OPERATING SHAKING SCREENS IN COAL MINE

elapses with the car in uniform motion; five seconds is required in retarding the car, and six seconds is required in dumping and caging. Each car is capable of carrying 1.5 tons to 2 tons. The two cars are balanced on the opposite ends of the hoisting cable and are driven by a 150-hp wound-rotor Westinghouse motor, which is connected to the hoisting drum through one reduction of herringbone gears. An operator at the top of the shaft controls the hoisting motor and brakes.

The coal is lifted 30 ft. above the ground and dumped into shaker screens where the different sizes of coal are sorted. These screens are 8 ft. wide, 2 ft. deep and from 12 ft. to 25 ft. long. A two-speed Westinghouse squirrel-cage motor operates the screens. Two speeds have been chosen in operating the shakers, as it has been found that when the quantity of coal in the shaker is considerably lower than the normal amount the screens are shaken to pieces by vibration.

In new mines in this district experience has shown that 20,000 cu. ft. of air per minute is sufficient for ventilation. As the mine grows older and more veins are opened up, the liability of stagnation increases and as high as 150,000 cu. ft. of air per minute is required. The ventilating fan in the O'Gara mine is geared to a 50-hp, two-speed, squirrel-cage Westinghouse motor. During the eight hours of the

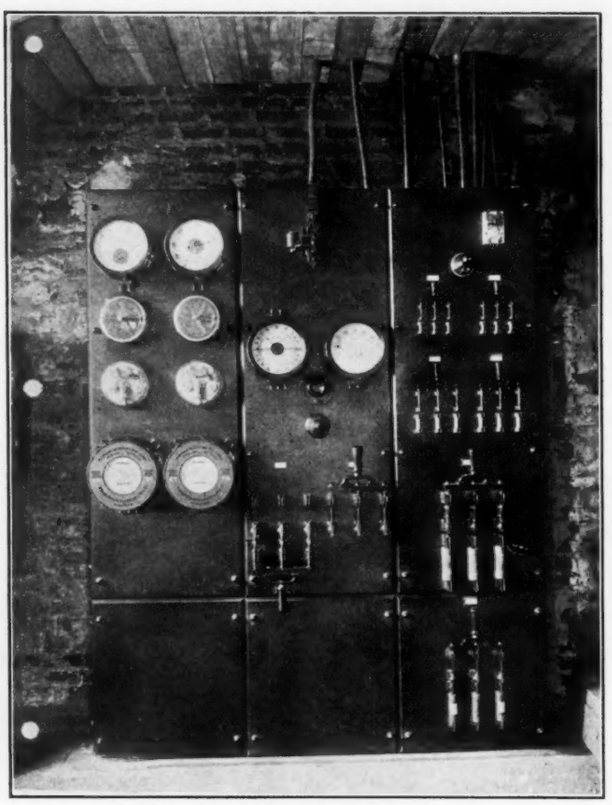


FIG. 6—SWITCHBOARD INSTALLED IN HOISTING ROOM OF COAL MINE

day when the men are working the fan is operated at full speed; at other times it operates at half speed.

As the coal is mined it is loaded into cars which are pulled to the hoisting cage by a Morgan-Gardner electric locomotive. This locomotive is operated from a 270-volt trolley wire and is capable of pulling an 8-ton load. The highest pressure of any exposed conductor in the mine is 300 volts.

In the blacksmith shop is a 5-hp Westinghouse squirrel-cage motor which operates a blower furnishing a draft for the forges. This motor is run at an operating speed of 1130 r.p.m.

Alternating current is used for most of the motors in the mine, but the locomotive requires direct current. A 100-kw rotary converter is installed in the hoist operator's building on the surface for furnishing 250-volt to 275-volt direct current. In the same building with this rotary converter are the hoisting motor, the control apparatus and the switchboard.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Reciprocity in Advertising

Mr. D. H. Howard, advertising manager of the Commonwealth Edison Company, in a recent issue of *Printers' Ink*, calls attention to an example of reciprocity in advertising. He speaks of a street-car card of the National Biscuit Company bearing the words "Refreshing Uneeda Biscuit" and illustrated by a picture of an electric fan running full blast. The idea of the fan and its refreshing breezes is conveyed no less prominently than the merits of the crackers. Mr. Howard thinks that this street-car advertising is no doubt responsible for the sale of many electric fans. The advertising department of the Commonwealth Edison Company, to show its appreciation, thereupon represented a box of Uneeda biscuit on a dining table in one of its newspaper advertisements exploiting the use of the electric fan.

Revenue from the "Turn-Down" Lamp

The Fort Wayne & Northern Indiana Traction Company, which supplies energy for lighting and commercial purposes in Fort Wayne, Ind., is making a special campaign in "turn-down" lamps for residence use, advantage being taken of the window display loaned by a lamp manufacturer. This display consists of a miniature theater with a revolving stage and shows toy figures operating two-filament turn-down lamps as the curtain rises and falls upon the four different scenes.

The new-business department of the Fort Wayne company believes that these lamps are a material help in increasing customers' monthly bills and in filling out that part of the early morning load curve which is invariably low. Tests made with a turn-down lamp show that if it is operated ten hours each night, a rather large estimate, the monthly bill of the customer will be increased 12 cents. The company sells the lamps for 45 cents and is giving its patrons the privilege of renewing them at an additional cost of 30 cents each.

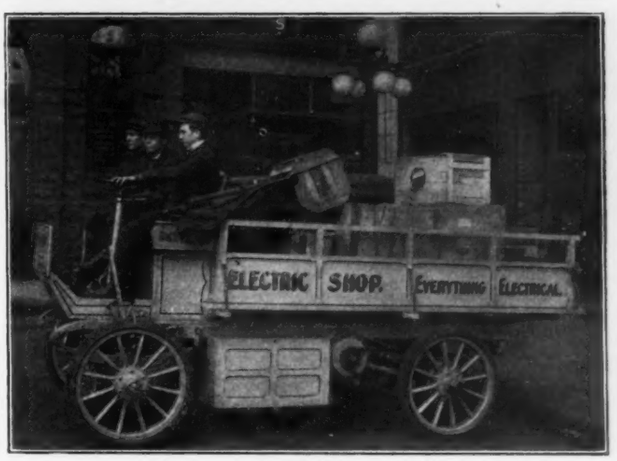
Increasing Sign and Show-Window Lighting Revenue

The Commonwealth Power Company, Jackson, Mich., is making a general canvass for sign and show-window lighting business. In eight days at Jackson, with the assistance of representatives of the Federal Sign System (Electric), contracts were closed for ten signs, which will increase the monthly revenue about $150. These signs were purchased outright by the customers and are lighted and maintained by the electric-service company at a flat rate which is very reasonable. This charge also provides for washing the signs, replacing burned-out lamps, and switching the lamps off and on. This company does not urge the use of transparent signs, as illuminated lamp-letter signs demand more energy.

Along with the sign campaign the company is endeavoring to secure long-hour show-window lighting business. Formerly the majority of the local show-window lamps burned from dusk until 9 p. m., but in four days of the campaign fifteen merchants were induced to keep their lamps lighted until 11 p. m. For the latter service the flat monthly rate of 75 cents per 100-watt tungsten lamp and 50 cents per 60-watt unit is made. This charge includes also lamp renewals and the patrol service of the men who turn the lamps off and on.

Delivery Service with Electric Truck

The accompanying illustration shows the electric truck used by the Republic Railway & Light Company, of Youngstown, Ohio, for conveying supplies to its storeroom and electric shop and for delivering to customers purchases made in its retail display rooms. The truck is attractively finished in white enamel and bears on its side the legend "Electric Shop, Everything Electrical." On the dashboard appear the words "We do wiring."



ELECTRIC DELIVERY TRUCK, ELECTRIC SHOP, YOUNGSTOWN, OHIO

Youngstown's Electric Shop

The Republic Railway & Light Company, which controls the Youngstown (Ohio) Consolidated Gas & Electric Company and several electric-railway properties operating in and about Youngstown, has established an electric shop in connection with the railway ticket office of the company. All ticket purchasers are thus obliged to go to the electric shop if they wish to save money by avoiding cash fares. Lighting and motor-service bills are also paid here. Fig. 1 is an exterior night view of the Stambaugh Building, in which the electric shop is located. The situation of the building on the main square of the city gives a place of prominence to the electric-shop sign. Light from the ornamental lighting posts in front is also reflected from the white walls of the building, making it stand out clearly against the darker background.

The sign on the corner spells and flashes the words "The Electric Shop," while the zigzag border in red and white tungsten lamps simulates a lightning discharge about the edges of the sign. Four large panels of the display window immediately adjoining the corner are occupied by timely exhibits of electrical merchandise. The flasher for the

large electric sign holds a permanent place in the corner of these show windows and furnishes a never-ending source of attraction to persons gazing at the displays. It was originally thought that the flasher would be kept in this position only temporarily, but the arcing contacts on the revolving drum have proved of so much interest to the public that a change has never been deemed advisable.

FIG. 1—EXTERIOR NIGHT VIEW OF YOUNGSTOWN'S ELECTRIC SHOP

Fig. 2 shows the front portion of the large room occupied by the electric-service company, and it is this part which is properly known as the electric shop. At the rear of this room a row of ticket-sellers' cages, an information desk and a counter screen the office from the sales and demonstrating space. No price-cutting competition marks the sale of appliances from the electric shop, for in all cases standard retail prices are maintained, approaching as nearly as possible those of the local supply dealers. Demonstrations of appliances are given on request. The

FIG. 2—CIRCULAR DISPLAY COUNTER IN ELECTRIC SHOP, YOUNGSTOWN, OHIO

desk of the lady demonstrator may be seen within the circular display counter (Fig. 2).

Many forms of advertising are utilized by the company to call attention to the features displayed at the electric shop. A weekly electrical page in a local newspaper carries stories of popular electrical interest clipped from the technical press. About these short articles are grouped advertisements telling of the devices on sale at the electric shop. Other display advertisments are run daily. During holiday periods billboard advertising is used extensively.

Mr. J. Hartshorn is lighting contract agent of the Youngstown Consolidated Gas & Electric Company and manager of the electric shop.

Securing Full-Schedule Business from Present "Breakdown-Service" Customers

The isolated-plant owner who is already buying insurance against breakdown in the form of a readiness-to-serve arrangement with the central-station's system often constitutes one of the salesman's best "prospects" for full-schedule central-station business. To shut down such an isolated plant altogether it should be necessary only to show the owner how heavily his power service is costing him, when he adds to the plant costs per kilowatt-hour the flat charge made by the company for what it denotes its "breakdown-service connection." This flat monthly or annual breakdown-service charge is properly distributable over the total number of kilowatt-hours actually generated by the isolated plant, so that one may consider the breakdown insurance element of the total cost in terms of so many cents per kilowatt-hour of isolated plant output, even though the central station's lines may never be called on for relay service.

RELATION BETWEEN LOAD-FACTOR AND UNIT COST OF "READINESS-TO-SERVE" UNDER BREAKDOWN

Load-Factor, per Cent	Cents per Kw-hr.	Load-Factor, per Cent	Cents per Kw-hr.
5.0	5.48	40.0	0.69
7.5	3.65	50.0	0.55
10.0	2.74	60.0	0.46
15.0	1.82	70.0	0.39
20.0	1.37	80.0	0.33
25.0	1.10	90.0	0.30
30.0	0.92	....	....

Obviously, also, the magnitude of this "breakdown" charge entering into the total cost of a given kilowatt-hour will depend upon the load-factor under which the customer's plant is operating, being inversely as the number of hours of service. If the salesman can quickly estimate this "breakdown" element from the customer's conditions of connected load, load-factor and "breakdown-service" rate, the result, added to the admitted or proved cost of isolated-plant output, will usually show a total cost per kilowatt-hour much in favor of straight central-station service. Especially is this true if the customer's load-factor is comparatively low, since then the small unit output of the plant has to be saddled with the entire "readiness-to-serve" insurance cost.

A certain Eastern central station makes a "breakdown-service connection" charge of 10 cents per month per 50-watt equivalent connected, which expressed in other terms is $2 per connected kw per month. In a given plant the actual number of hours' use per day will be represented by the product of the load-factor and 730, the number of hours in the average month. For each kilowatt-hour of isolated-plant output the unit insurance charge against breakdown will therefore be

$$\frac{\text{Breakdown charge per kw}}{730 \times \text{load-factor}} = \frac{\$2.00}{730 \times \text{load-factor}} = \frac{\$0.274}{\text{load-factor}}$$

Hence, under the two-dollar rate quoted, dividing 27.4 cents by the load-factor of the installation gives the in-

surance charge to be shared by each kilowatt-hour of isolated-plant output. Thus it becomes possible to convert any table of load-factors, such as those given in the N. E. L. A. Solicitors' Handbook, to a table detailing the probable unit cost of breakdown service to these different classes of customers. Scrutiny of such figures will then suggest to the central-station salesman where his chief opportunity lies and whether the rate schedule available offers any advantage for the isolated-plant customer to use straight central-station service. The accompanying table shows the unit insurance cost of "breakdown readiness-to-serve" per kilowatt-hour of isolated-plant output for various customers' load-factors. In these figures a breakdown readiness-to-serve charge of $2 per connected kilowatt is made, but no central-station energy is assumed to be used.

Pittsburgh's Solution of the Small Customer Problem

The Duquesne Light Company, Pittsburgh, Pa., at present has connected to its circuits some 2800 customers receiving service through excess indicators on flat-rate contracts. Of these customers 60 per cent are commercial and 40 per cent are residential patrons who have been secured during two and one-half years of constant co-operative soliciting by the central-station company and the manufacturer of the indicators.

The methods used in securing this business may be outlined as follows: Solicitors in the employ of the Excess Indicator Company were supplied with such information regarding prospective customers as was available and were provided with blank contracts under the lighting company's name. The size of the contract which these men could attack was limited, however, by the fact that the indicators are regularly made in ratings only up to 10 amp and on special orders to 20 amp. The lighting company specified that no contracts should be closed calling for a connected load of less than 100 watts. For commercial customers a gross rate of 1.35 cents per watt connected was quoted, 0.1 cent discount being given for payment of bills before the tenth of the month. Residential patrons, on the theory of being short-hour users, received a rate of 1.1. cents per watt connected, with a 0.1-cent discount for prompt payment.

In almost no case has the company taken contracts for wiring new houses, it having relied upon the contractors to handle this business. However, eight solicitors are hard at work most of the time in securing contracts for wiring existing buildings. The friendly relations which have been maintained with the contractors have gone far in aiding the company to secure the small customer.

Viewed from the customers' standpoint the electrical energy purchased on this flat-rate contract is inexpensive. In the average commercial installation the lamps are operated nine hours each day for twenty-six days in a month, making a total operating period of 234 hours. Assuming that the connected load is 1 kw and the net price is 1.25 cents, the monthly bill will be $12.50, indicating a rate of approximately 5 cents per kw-hr. As the hours of operation are increased the kilowatt-hour rate to the customer is made to appear more favorable, until, upon reaching the maximum monthly period of operation, 720 hours, the rate becomes about 1.4 cents per kw-hr.

From the viewpoint of the company the flat-rate offer is also extremely attractive. A 1000-watt installation brings to the company's treasury each month $12.50, or $150 annually. When it is considered that many companies earn less than $50 per connected kilowatt per year the desirable nature of such business will be readily apparent. There are other advantages accruing from the use of the indicators which cannot so readily be estimated in dollars and cents. For instance, a considerable reduction in transformer ratings has been noticed in communities where the majority of customers are using the indicator, for although each customer may have installed on his premises a large number of lamps, he can operate only a limited number at any time.

No trouble is reported in Pittsburgh from customers endeavoring to use electrical appliances of high wattage ratings on circuits connected for light indicator loads. The experience there has been that as soon as the customer is educated to the point where electrical appliances are desired his business can be obtained on a metered basis.

The 2800 flat-rate customers on the Pittsburgh company's circuits have added in round numbers 500 kw of connected load to the system. Thus these are really the small customers, as the average connected load per customer is about 180 watts, and the average monthly bill is something over $1.90.

Another form of contract much in use by Pittsburgh's householders requires that the patron pay a "fixed charge" of 15 cents per month for each room and main hall on the first floor, 5 cents per month for each room on the upper floors and 2 cents for each lamp outlet on the premises in excess of fifty. Upper halls and bathrooms are not charged for. In addition, the customer agrees to pay an energy charge of 6 cents per kw-hr. for all energy consumed. It is specified that the minimum fixed service charge shall be 65 cents per month. Data collected by the company show that this charge averages about 75 cents. This contract was introduced for the advantage of the residential patron whose monthly bill was more than $1.50, and it is recommended to those wishing to withdraw from the flat-rate contract. Although at the time of introduction of this contract it was feared that the revenue of the company would be decreased, the effect has been found to be in the opposite direction.

Detroit Crematory Using Electric Blower

The Woodmere Cemetery Association of Detroit is using a motor-driven compressor to furnish air for operating the oil jets in its crematory and for concentrating the flames on the body being consumed. Air from this compressor is also utilized to separate the human ashes from the wood ashes of the casket. Two incinerators are now installed in the same building with the chapel and catacombs, while the air compressor is located in an outbuilding about 100 ft. distant.

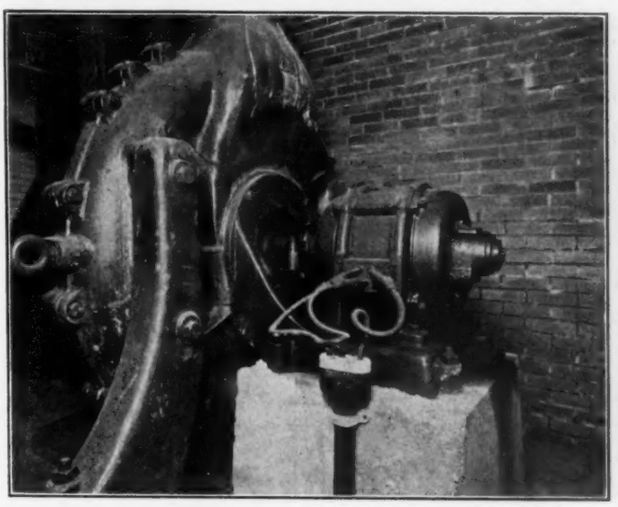


FIG. 1—MOTOR-COMPRESSOR SET USED IN CREMATORY

Apparatus for controlling the compressor motor is installed in the crematory where it can be operated by the

man in charge of the cremation. Service wires leading to the distant motor are run in underground conduit. In Fig. 1 is shown the combination General Electric compressor-motor set, which is capable of delivering 1600 cu. ft. of air per minute against a pressure of 2 lb. per sq. in. A blast gate in the air-intake pipe is used to throttle the air entering the compressor to meet the requirements of the crema-

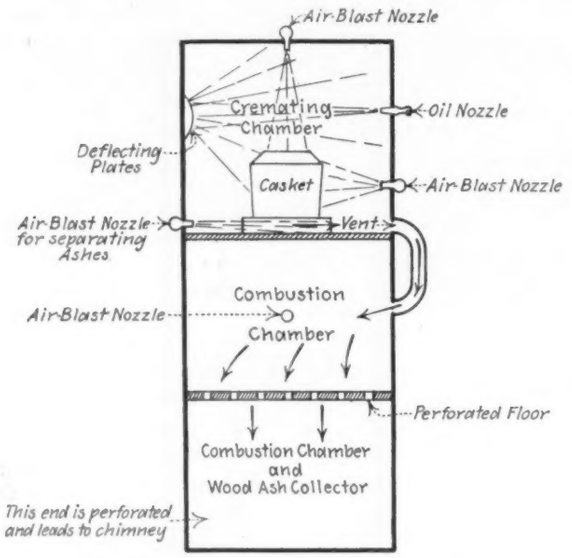


FIG. 2—CROSS-SECTION OF INCINERATOR IN DETROIT CREMATORY

tory. The impeller in the compressor case is overhung on its shaft, the entire revolving unit being supported by the motor bearings.

From the compressor the discharge pipe runs underground to the crematory, where a vertical riser connects it with a horizontal pipe supported from the ceiling. Fig. 3 shows the two incinerators installed here. In the center of this room the discharge pipe divides into three branches —one leading to each of the two incinerators to provide air

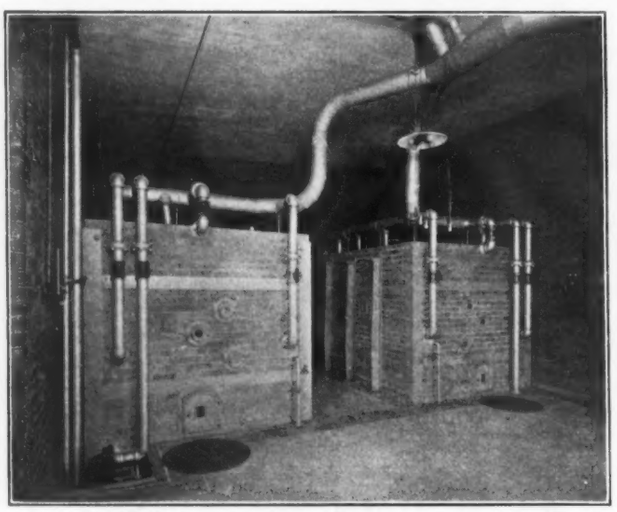


FIG. 3—INCINERATORS IN DETROIT CREMATORY

for oil jets and air blasts, and the third to a vent in the roof. Valves in these pipes, which are operated by chains shown hanging from the center of the ceiling, regulate the total amount of air delivered to each incinerator and allow the excess to escape through the vent in the roof.

Each incinerator unit consists of three compartments grouped as shown in Fig. 2. The arrangement of oil jets and air blasts to cremate the body and to separate the human and wood ashes is of special interest. Three oil jets along one wall of the upper chamber spray ignited oil against the deflecting plates on the opposite wall, while air blasts on the two side walls and ceiling concentrate the flames on the coffin. As the casket and body are consumed the ashes from both are mingled and in falling to the floor are intercepted by a horizontal draft of air which carries the lighter wood ashes through vents into the combustion chambers below. The human ashes, which are denser than the wood, drop to the floor of the upper chamber where they remain until raked into urns. Contrary to the familiar practice of power-plant furnaces, the path of the gases is downward as indicated by the arrows in Fig. 2. The two lower chambers are equipped with air blasts and baffles which cause complete combustion of the gases given off during reduction of the body, thereby eliminating disagreeable odors.

Before a body is placed in the incinerator the chamber is heated for twenty minutes. The casket is then slid in on rollers and a temperature of 3000 deg. Fahr. maintained. In these incinerators the time of cremation is reduced to one hour and twenty minutes. The Detroit crematory has been in operation since April, and up to Nov. 6 twenty-four bodies were cremated with an average oil consumption of 30 gal. per body. Experiments are being conducted to find the effect which preheating the air blast will have on the oil consumption.

The motor-driven compressor is especially suitable for this purpose, as it can be placed in an outbuilding without attendance and can be controlled by the person in charge of the cremation.

Local Activities in the Electric Vehicle Field

Some interesting reports of the work done in encouraging electric-vehicle sales by local sections of the Electric Vehicle Association of America were presented at the recent Chicago convention of the association. Mr. Homer E. Niesz reported for the Chicago Section, Mr. J. A. Hunnewell for the New England Section, Mr. Harvey Robinson for the New York Electric Vehicle Association, and Mr. Day Baker for the Electric Motor Car Club of Boston.

The work of the New York Section is carried on largely through committees. Its committee on charging stations establishes new stations where needed and keeps electric-vehicle owners informed of the location of all stations. The committee on traffic and service runs arranges electric-vehicle parades and other public demonstrations. For gathering data on relative costs the committee on operating cost has been appointed. All laws affecting traffic are investigated by the committee on legislation. Another committee has been seeking to establish a co-operative garage and service station to be supported by all the local vehicle interests.

During the past year the New England Section has instituted a sales and advertising convention and has employed a permanent business secretary. In addition to carrying on publicity campaigns this section has also taken an interest in traffic regulation and recently secured the abandonment of the Massachusetts motor-truck fee bill. During the coming year an aggressive membership campaign will be launched.

The Chicago Section has held weekly meetings during the entire year, the enthusiasm of its members remaining at a high pitch throughout the summer months, when most organizations suspend their usual activities. It is reported that the "second-hand car bugaboo," still a nemesis of the trade, will soon be made the point of attack in a well-defined movement designed to bring about a solution of this troublesome problem. The section has taken advantage of

many holiday celebrations in and about Chicago in arranging demonstrations to promote publicity of the electric vehicle.

Mr. E. E. Witherby, of Chicago, urged pleasure-car men to "get into the game" and push their product as the commercial-vehicle men have done. Mr. W. J. McDowell, of the same city, spoke of the fight made by the Chicago Section against an ordinance reducing the period of curb stops from sixty to thirty minutes. As a result of this effort, action on the ordinance has been deferred. Mr. F. W. Smith, of New York, declared that if more garage facilities were available the demand for pleasure vehicles would exceed that for commercial wagons.

During the winter of 1912 and 1913 the Electric Motor Car Club of Boston held fortnightly meetings, the dates of these sessions being arranged to coincide with the monthly meetings of the New England Section of the Electric Vehicle Association of America. The members of the club are drawn from among vehicle owners and those interested in the trade who reside within 50 miles of Boston. The club has carried out a series of co-operative advertisements in the Boston *Transcript* and other daily papers. To indicate the results of the concerted advertising and co-operative efforts the accompanying table is given, showing electric-vehicle registrations in Massachusetts on Aug. 9, 1912, and Aug. 9, 1913.

NUMBER OF ELECTRIC VEHICLES IN MASSACHUSETTS

	1912	1913	Gain	Per Cent Gain
Passenger	425	557	132	31
Commercial	210	384	174	82.8
Total	635	941	306	48

President F. W. Smith read a communication from Mr. Joseph E. Baker, of Spokane, Wash., in which the writer offered to organize a Pacific Section with Spokane as its headquarters.

Experiments in Electroculture Near Dayton, Ohio

By Dr. Herbert G. Dorsey

At Moraine Farm in the fertile valley of the Miami River, about 4 miles south of Dayton, Ohio, experiments have been carried on during the last year to discover the effect of electricity and artificial illumination on the growth of vegetation. In the preliminary tests a number of small plots were marked off for exposure to different kinds of electrification, the idea being to carry out later on a larger scale those methods which offered the greatest promise. In order that the soil should be uniform in the test plots, the top earth was first collected, thoroughly mixed and sifted, and then laid to a uniform depth of about 7 in. over the entire test area.

Plot No. 1 was excited by high-frequency currents from a small Tesla coil. A transformer stepped the 110-volt, 60-cycle alternating current up to 5000 volts, charging a condenser of tinfoil and glass plates which discharged through the primary of the Tesla coil and a spark-gap. A network of No. 30 B. & S. gage wire stretched about 15 in. above the plot was connected to one terminal of the Tesla coil, the other terminal being led to a wire screen which was buried in the earth. The transformer and coil took about 130 watts and were operated one hour morning and evening. The potential difference between the soil and overhead wires was about 10,000 volts and the frequency perhaps 200,000 cycles per second.

Extending Illumination by Artificial Means

Plot No. 2 was illuminated by a 100-watt tungsten lamp with ruby bulb three hours daily, beginning at sundown. Plot No. 3 was illuminated by a Cooper Hewitt mercury-vapor lamp three hours per day, beginning at sundown. Plot No. 4 received no artificial stimulation, but was used as a "control" so that comparisons might be made between the plots receiving excitation and one receiving none.

In plot No. 5 was buried a wire network connected to the negative terminal of a 110-volt direct-current circuit. The latter's positive terminal was led to a small sprinkling can having a carbon electrode in the middle insulated from the can itself which could be connected to the negative side. The can being filled, the water was first subjected to electrolysis for about three minutes. During this time the temperature of the water would rise from about 70 deg. Fahr. to 90 deg. Fahr., becoming filled with gas by the evolution of oxygen and hydrogen. While still bubbling, the negative terminal to the can was opened and the plot sprinkled, the idea being that current might flow from the can through the streams of water to the soil.

Plots Nos. 6 and 7 were subdivided into four individual boxes, 2 ft. square, each separated by porcelain insulators and arranged with carbon electrodes at opposite ends. To these electrodes were applied both alternating and direct current taken from commercial-lighting sources and from

PLOT FOR HIGH-FREQUENCY ELECTROCULTURE EXPERIMENTS AT MORAINE FARM, NEAR DAYTON, OHIO

dry cells. Some of the boxes were excited only after germination. The currents flowing were found to vary from 0.0003 amp to 0.0700 amp depending on the moisture present. All such current-flow results were, however, uniformly negative, germination being retarded and growth stunted.

The plots tested were planted with radish and lettuce seed, samples of which had previously been tested for germination. No stimulation was attempted on plots Nos. 1 to 5 until after germination. The seeds were planted Jan. 16, and on Jan. 29 stimulation was begun on Plots 1, 2, 3 and 5. About three weeks later ten plants each of radishes and lettuce were selected at random from the five plots and weighed as shown in the accompanying table.

From this table it will be seen that the plot subjected to the high-frequency current showed a greater increase in yield than any of the others. Ruby light ranged second for radishes, while violet light was second for lettuce. The electric-sprinkling system apparently proved worse than no stimulation at all. Comparing the high-frequency plot with the control plot, the edible portion of lettuce grown is 75 per cent greater than under natural conditions.

An attempt was next made to repeat the experiments, using tomatoes and cucumbers, but the investigators were prevented from getting any results because of interruption by the Dayton flood.

The results obtained from the high-frequency tests seemed, however, sufficiently encouraging to warrant starting work on a larger scale. A 2-acre plot of good soil in a flat field was accordingly selected to be used as a house garden and was arranged to be sprinkled by an overhead system of pipes supported from a catenary suspension system 14 ft. above the ground. The pipes ran east and west a distance of 200 ft. and were spaced at 50-ft. intervals north and south for a distance of 400 ft. In the northeast corner of this garden seven wires of No. 12 B. & S. hard-drawn copper were stretched north and south 200 ft., the wires being 9 ft. above ground and 15 ft. apart. The ends of the wires were attached to insulators on top of 4-in. gas pipes set in concrete, and at the middle they were supported by suspension insulators from one of the sprinkling pipes. The insulators used had been built for 60,000-volt work. The wires were elevated sufficiently for the soil to be plowed with horses. It should be noted that the high-frequency system was independent of the sprinkling system. Occasionally the two were run at the same time.

RESULTS OF TESTS IN ELECTRIC STIMULATION OF VEGETABLES

	Plot 1, Tesla	Plot 2, Ruby Light	Plot 3, Mercury Vapor	Plot 4, Control	Plot 5, Electric Sprinkling
Radishes (ten plants selected at random):					
Total plant weight, grams	265.70	137.80	109.50	180.00	78.50
Edible portion, grams	139.50	57.40	40.90	79.40	31.00
Edible portion, per cent	51.15	41.65	37.34	44.11	39.49
Tops and leaves, grams	120.50	75.70	65.90	95.00	41.50
Tops and leaves, per cent	45.35	54.92	60.18	52.77	55.66
Roots, grams	9.30	4.70	3.20	5.60	6.00
Roots, per cent	3.50	3.43	2.48	3.12	4.85
Lettuce (ten plants selected at random):					
Total plant weight, grams	67.00	52.60	56.50	46.10	31.30
Edible portion, grams	60.70	47.30	50.20	41.80	28.20
Edible portion, per cent	90.59	89.92	88.85	90.67	92.10
Roots, grams	6.30	5.30	6.30	4.30	3.10
Roots, per cent	9.41	10.08	11.15	9.33	7.99

At the eastern edge of this plot was built a small transformer house in which a 7.5-kva transformer stepped up 220-volt, 60-cycle energy to 11,000 volts. A choke coil was placed in series with the primary. The secondary was connected to a spark-gap and shunted across this was the condenser in series with the primary of the Tesla coil. The primary of the Tesla coil was made of eight turns of No. 0000 wire and the secondary consisted of seventy-five turns of No. 14 B. & S. gage on a wooden drum 15 in. in diameter and 18 in. high. Both primary and secondary were immersed in a 50-gal. stoneware jar filled with transformer oil. The lower end of the secondary was connected to the pipes of the sprinkling system which furnished a ground connection, and the upper end was led out through a 60,000-volt bushing to the middle of the antennas. The spark-gap was formed of two rectangular boxes of thick copper with two faces parallel but separated by 0.25 in. The boxes were hollow and filled with water and gave excellent service as a stationary spark-gap.

Difficulties in Beginning Operation

Considerable difficulty was experienced in getting the system to work properly. Condenser plates were continually breaking down until the condenser was built of old photographic plates 8 in. by 10 in., using two glass plates and then a sheet of tinfoil. Two boxes containing about 300 glass plates, each filled with transformer oil, gave a good condenser of about 0.1 mf capacity. Such a condenser did not break down, and it was not even necessary to remove the coating from the plates.

It was the latter part of July before the system could be considered in perfect working order. At that time a pressure of 50,000 volts was being given as measured by the needle spark-gap between the antennas and earth. The garden was then electrified daily from 6:30 to 9.30 a. m. and from 1:30 to 3:30 p. m.

The frequency of the oscillatory currents was estimated to be about 30,000 cycles per second, and at 50,000 volts sufficient energy was radiated from the lines to give to birds attempting to light on the wires a shock that felled them to the ground partially stunned. None, however, was actually killed. The total energy consumed from June to Sept. 1 was 221 kw-hr. Of this amount probably half was wasted in the inefficient choke-coil.

The accompanying illustration shows the garden in early summer. No attempt is made to indicate comparative sizes of the vegetables. The transformer house appears in line with the gardener's dwelling.

Because of the delay in getting the system in good working order, only qualitative rather than quantitative data are available. However, it was very apparent that almost all the vegetables grown under the wires were better than those not electrified. The plants stimulated included radishes, lettuce, beets, cabbage, cucumbers, turnips, muskmelons, watermelons, tomatoes and parsnips. Little or no difference could be observed in beans and peas. The gardner in charge, however, picked almost all the others at least two weeks earlier under the wires than in the unelectrified portions.

All these different vegetables were planted in rows running east and west so that one-half of the row was electrified while the other half was not. Actual weights were obtained only in the case of tobacco. One end of a row was cut under the wires and the plants averaged 1687 grams each. One week later the other end of the row was cut and the plants averaged 1632 grams per plant, so that electrification may be credited with a gain of 55 grams per plant, or an increase of 3.35 per cent. But since the most rapid growth of tobacco occurs during the last two weeks, it is estimated that the increase in weight had both ends of the row been cut at the same time would have been about 20 per cent.

No satisfactory theory is at present offered to explain the increased yield due to high-frequency electrification. It is felt that insufficient data are yet at hand to form any theory or to determine whether such experiments will be successful from the financial standpoint or not. In the present case the expenditure was much greater than the increased yield gained. Several questions arise which it is hoped will be answered some time during the next year, among them: Is the effect due to the potential gradient between the wires and earth, or simply to the total potential difference? Does the effect depend on the frequency of the current, and, if so, what is the best frequency? What is the best amount of stimulation? If any of these problems can be solved during the present winter in the greenhouse, the results will be utilized in the larger experiments during the next summer.

"Mechanical Man" as Show-Window Attraction

When the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., opened its offices and showrooms in the building at the corner of Park Avenue and Liberty Street, it secured the services of a young man who had been posing in local windows and moving-picture shows as a "mechanical man." As mentioned in these columns at the time, the crowds which he drew were very large. Since then the interest manifested by the public in the poser's unusual skill has continued so great that the company has now retained his services altogether for more than six months. The mechanical man is at present being used to demonstrate the electrical appliances which the company has on sale. He adopts a different "make-up" for each demonstration and his female impersonations have aroused particular interest.

Illumination and Wiring

A Jeweler's Push-Button Lighting Scheme

Next to the plan of having continuous adequate illumination of his store to attract the attention of the passing public, a novel scheme devised by a Western retail jeweler has secured for him a measure of publicity quite out of proportion to its cost. This dealer has had all the lamps in his store wired to a switch which can be operated by a push-button outside the entrance. Over the button is mounted a sign reading, "You can see our store by pushing this button." Many of those who pass during evening hours yield to their curiosity and push the button. The lamps are cut off automatically as soon as the switch is released. This scheme has caused considerable local comment.

Bracket-Type Arc Lighting at Niagara Falls, N. Y.

A handsome ornamental installation of 224 magnetite-arc lamps has just been inaugurated on Falls Street, Niagara Falls, N. Y. There are 112 tubular-steel poles each carrying a double bracket which supports two General

BRACKET-TYPE MAGNETITE-ARC LIGHTING AT NIAGARA FALLS, N. Y.

Electric inverted-type magnetite-arc lamps. The posts, which are installed at intervals of 70 ft., are made up of standard 7-in., 6-in. and 5-in. tubing and also serve to support the trolley span wires. Series circuits feeding the lighting installation are carried on overhead brackets at the peaks of the poles. Provision has been made, however, by leaving slots in the pole butts below the ground line, so that at some future time the wires may be placed underground in conduit. The poles and brackets are provided with the Electric Railway Equipment Company's positive cut-out. With this it is not necessary to remove the cover portion of the bracket in order to operate the cut-out, as a chain and ring below the brackets serve this purpose.

Energy to operate the Falls Street lighting system is furnished free of charge by the Hydraulic Power Company and the Buffalo & Niagara Falls Power Company, while the poles were erected by the International Electric Railway Company, whose trolley spans the posts support. The installation was carried out under the supervision of Mayor Laughlin of Niagara Falls and Mr. M. J. Donohue, city electrician.

Support of Long Transmission Span by Messenger Cable

After the completion of the Eastern Michigan Edison Company's hydroelectric plant at Ann Arbor, Mich., an unexpected market for energy opened up in two towns, to the north and west respectively. To transmit energy to the latter place by the shortest practicable route, it was

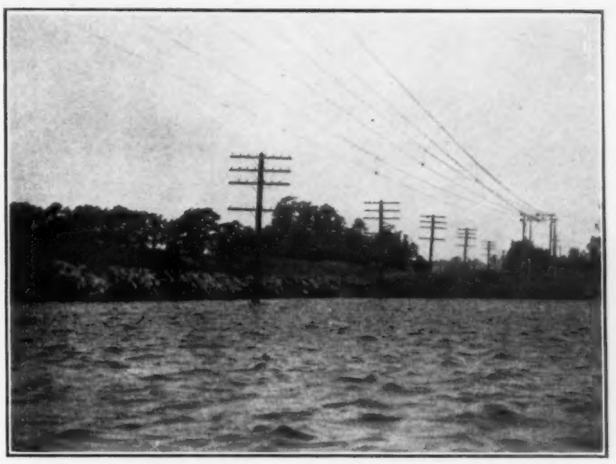


FIG. 1—1000-FT. SPAN SUPPORTED FROM MESSENGER CABLE

necessary to string the 23,000-volt conductors across the pond above the dam, requiring a span of about 1000 ft. Figured for tension, No. 0 hard-drawn copper wire was found to have just sufficient strength to be used safely on this span. However, while a jumper from the station high-tension bus was being soldered onto one of the span wires the heat of the solder annealed the hard-drawn copper, so far reducing its strength that the conductor broke under its own tension.

To avoid using the larger wire needed to withstand the tension, the construction shown in diagram Fig. 2 was then adopted. H-shaped wooden frames, as shown in Fig. 1, were built and erected on each side of the pond as dead-end towers. Back of each on its land side another H-shaped frame was erected to help withstand the horizontal pull of the long span.

The main dead-end towers are constructed of 45-ft. poles with 8-in. tops and are provided with two cross-arms, as shown in Fig. 2. Attached to each arm are three 30,000-

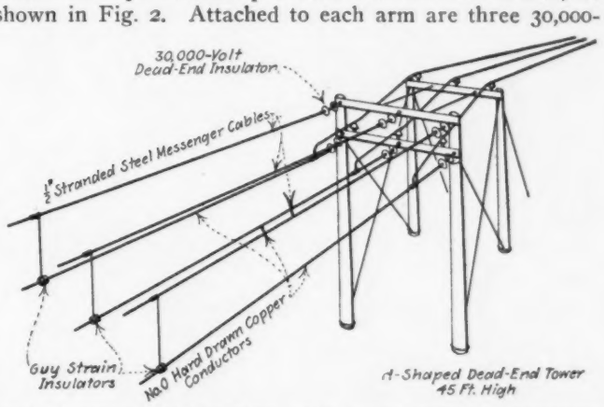

30,000-Volt Dead-End Insulator
½" Stranded Steel Messenger Cables
Guy Strain Insulators
No. 0 Hard Drawn Copper Conductors
A-Shaped Dead-End Tower 45 Ft. High

FIG. 2—LONG TRANSMISSION SPAN SUPPORTED BY MESSENGER CABLES

volt dead-end strain insulators, and crossing the pond between the insulators on the upper arms are strung three 0.5-in. stranded-steel messenger wires. Suspended from the messenger wires at points dividing the span into three parts are hangers which support ordinary guy strain insulators. Through these pass the main copper conductors, which are dead-ended on the lower set of insulators. This

particular span was erected in July and a 20-ft. sag was allowed. Minor details, such as the guying of poles, connection of jumpers to span wires, etc., are shown in Fig. 2.

The line transmits energy at 23,000 volts to Dexter, Mich., where it is transformed to a lower potential and used in street and residential lighting. Energy for operating a sand and gravel pit is also supplied by this line. The general practice along the right-of-way has been to use 35-ft. poles with 175-ft. spans.

Water in Inclosed Flame-Arc Lamps

By W. R. Mott

It is well known that poor inclosure of flame lamps caused among other things by cracked, chipped or poorly seated globes is deleterious to the best burning conditions because it permits the inrush of excess air, thus deranging the natural ventilation system for the condensation of the fumes and allowing the arc to burn under more or less open arc conditions, which greatly shortens the life of a trim. The writer knows of no published data on the effect of water in the globes, and the results of such tests should therefore be interesting as showing the disastrous effects of even a small quantity of moisture.

Theoretical Consideration

Water vapor at high temperatures reacts with the carbon of the electrodes according to the following formula: $C + H_2O = H_2 + CO$. The free hydrogen thus formed is from an operating standpoint, because, in combining with the oxygen, explosions are extremely liable to occur which will often break the globes. Other points will be observed in connection with the test figures shown below.

As a counter-action to the formation of hydrogen, a few tests with carbon tetrachloride and similar materials have recently been made. The hydrogen combines with it as fast as formed according to the formula $2H_2 + CCl_4 = C + 4HCl$, but the hydrochloride acid thus formed would attack the metal of the lamp parts and this process cannot in its present form be considered commercially possible.

Tests

To obtain quantitative figures, tests were made on alternating-current series white-flame lamps, using two standard grades of white-flame electrodes called A and B below. In each case 1 liter of water was placed in the globe at the start and the lamp operated to the end of the trim. The amount of water then left was ascertained and the next test started with this quantity as a basis. This method was repeated until no water was left in the globe.

Discussion of Tests

In examining the results from the above test it will be noticed that the quality of the light emitted, at first a dim deep yellow, gradually improved as the water was expelled until a normal white was obtained when no moisture remained in the globe.

Poor inclosure in extreme cases will cause slag outages due to excess air alone, but this trouble seems to be greatly augmented by the presence of a large amount of water.

DATA FROM TESTS ON ALTERNATING-CURRENT SERIES WHITE-FLAME LAMPS

Test	Electrode	Water Present		Light	Outs		Points	Explosions on Pick-up	Globe Condition	Life, Hours	Hours per Inch		Arc Movement Down, In.
		At Start	At End		Slag	Sticking					Upper	Lower	
1	A	1 liter	230 cu.cm.	Dim deep yellow	2	1	Poor	?	Good except at water edge	14	2.95	3.35	0.5
2	A	230 cu.cm.	Very small	At start deep yellow	1	2	Poor	Very bad	Heavily coated, Some slight etching at water edge	43	8.20	9.90	0.8
3	A	Trace	None	At start yellow, then good white	0	0	Good	Two first ten hours only	Good. Some carbon dust. No etching	126	21.00	30.80	0.2
4	A	None	None	Excellent brilliant white	0	0	Good	None	Good. Some carbon dust. No etching	139	23.20	33.80	0.1
5	B	1 liter	135 cu.cm.	Dim deep yellow	0	3	Fair	?	Heavily coated and etched	17.75	2.65	4.80	...
6	B	135 cu.cm.	None	Dim deep yellow	0	0	Good	Very bad	Heavily coated, badly etched	44.25	5.37	10.40	0.5
7	B	Trace	None	Pink pearl white	0	0	Good	None	Coated. Some carbon dust. Apparently no etching	101.50	18.50	24.50	0.4
8	B	None	None	Good white	0	0	Good	One very slight	Coated. Some carbon dust. Apparently no etching	114.25	20.60	28.50	0.1

what causes the most trouble. Having not only the highest specific heat but the highest conductivity of any of the common gases, it rapidly conducts heat away from the arc. Moreover, in the immediate neighborhood of the arc, the water vapor may be directly broken down into its constituents, hydrogen and oxygen, with the loss of their great heat of reduction. From these two causes the temperature of the arc is greatly reduced, and the light given off, instead of being of a brilliant white color (using white flaming electrodes), will be a poor dim yellow of low candle-power. Another objectionable feature of hydrogen is its ability to recombine with any oxygen present to form more water. This may assume the form of a regular cycle. The water is broken down into hydrogen and oxygen at the high temperature of the arc, taking its heat of reduction from the arc, with the further loss of heat due to the conductivity of the hydrogen. This hydrogen now passes out of the immediate vicinity of the arc to the condensing chamber where the temperature is low enough to permit of its recombination with any free oxygen present and there gives up its heat of combination where it is of no benefit but an actual detriment. The water vapor then travels back to the arc, and the cycle is repeated. Aside from illumination considerations, the presence of hydrogen is bad

Outages due to sticking of the electrodes in the holders were also observed, accounted for by the moist condition of the deposit. It will be noticed that these outages are of such a character that the lamp would not start again of its own accord. During the test a man started the lamps after each outage, but if such a condition occurred in practice, the lamp would remain inoperative until the repair crew arrived. With the electrodes used these phenomena occurred only when much water was present.

The condition of points speaks for itself.

Passing now to the occurrence of hydrogen-oxygen explosions, a question mark is found opposite tests Nos. 1 and 5 where the quantity of water present was large. Apparently any explosions which occurred were damped by the large volume of water vapor so as to be undistinguishable. The critical point seems to be between 50 and 150 cu. cm, where they were frequent and violent. They may, however, cause considerable trouble below this lower value.

The remarks under "Globe Condition" are self-explanatory. Apparently in test No. 8 there was some moisture in the form of vapor still in the lamp, causing the slight explosion noted and the rather poor globe condition.

It is in the life of the trim that the effect of moisture stands out most significantly. Under dry conditions the

life was 139 in test No. 4 as against 14 in test No. 1. The gain is nearly as striking between tests Nos. 5 and 8.

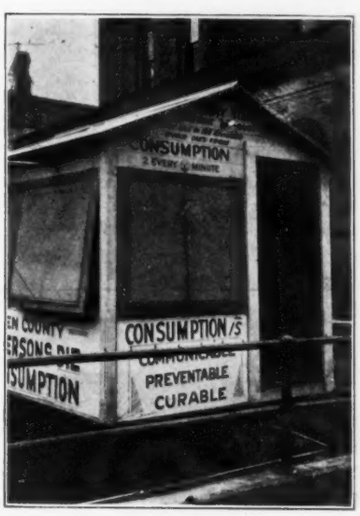
The electrodes taken by different lamps are of different lengths, and a trim of one lamp will therefore last longer than one from another lamp, so in order to obtain a fair basis of comparison the rate of consumption is measured in terms of hours of burning per inch length of carbon. The figures under these headings will be in approximate proportion to the life of the trim. Test No. 4 shows about the normal rate of burning under good conditions. The length of the upper and lower electrodes of a lamp is determined by their relative rate of burning so that both will be consumed in the same time. The presence of water changes this burning ratio, causing an abnormally rapid consumption of the lower, so that the arc moves downward. Should this continue, the lower will be entirely consumed before the end of the normal life of the trim and the lower holder will be burned.

CONCLUSIONS

The conclusions from this test are self-evident. One should keep the lamps in such shape that rain cannot enter the globes, and in trimming he should keep the electrodes dry because even a trace of moisture is detrimental. Finally oil or grease should not be permitted to get on the electrodes or in the lamps, for oil is a hydrocarbon which will break down into carbon and hydrogen under the action of the intense heat of the arc, with all the bad effects of the hydrogen from water.

Using Electricity in Tuberculosis Campaign

A determined struggle against the ravages of the "white plague" is now being waged at Fort Wayne, Ind., and the combating forces, headed by Dr. Eric Crull, have resorted to many interesting "kinks" in their attempt to raise funds from the sale of Red Cross stamps during the holidays. The little house shown in the illustration has been placed in a conspicuous position on the lawn near the post office, and, as the lettered sign explains, with each thirty-second interval at which the 25-watt lamp in the center of the gable is



BOOTH USING ELECTRIC LAMP TO ATTRACT ATTENTION

flashed on and off a death from tuberculosis occurs somewhere in the civilized world. The lamp is operated by a clockwork mechanism mounted just behind it on the wall inside.

Electricity for operating the lamps in this exhibit is supplied free of charge by the Fort Wayne & Northern Indiana Traction Company.

Recent Telephone Patents

Mr. A. E. Pool, of Wheeling, W. Va., is the patentee of a harmonic selective system. In this system the harmonic selection is accomplished by a harmonic relay having reed vibrators. All bells are operated by currents of the same frequency, and both the bell currents and the harmonic currents are introduced on the line simultaneously, except at the first station. The bell circuits are carried through the harmonic relays. For the first station bell current alone is introduced on the line, and all harmonic relays are inoperative. The bells at all other stations are shunted so that they fail to ring. For the second station the harmonic current introduced simultaneously with the bell current operates the reeds of the harmonic relays so that all save the desired bell are left shunted or open. For the other stations similar methods of operation are used.

LOCKOUT SYSTEM

In order to prevent interference on party lines, Mr. E. Bowman, of Elmwood, Ont., has devised a party-line lockout system. According to this system, after a connection has been effected, the calling party may lock out all other stations on the line by manipulating a key. However, in order to avoid abuse of this privilege, another key is provided at each station, by means of which anyone desiring access to the line may signal for the exchange operator, so that she may listen in and discover whether or not the parties talking are holding the line too long.

Letter to the Editors

Some Historical Inaccuracies

To the Editors of the Electrical World:

SIRS:—The beginning of an academic year offers a suitable opportunity for calling attention to some inaccuracies, mainly of a chronological character, which have found their way into textbooks on physics and which appear as regularly as edition follows edition. Though they may be considered of little moment, it will be conceded, nevertheless, that they are blemishes, and as such it is proper that they should be eliminated from the pages of manuals intended to serve as reliable guides for the student of physical science.

An early instance occurs in a well-known and widely used college textbook, in which it is said that the term "pole" as applied to magnets was first used by Gilbert in his Latin treatise "De Magnete," published in London in the year 1600. Three centuries before that date, however, the term *polus lapidis* (pole of the lodestone) was used not once but time and again by Pierre de Maricourt in the no less remarkable work of his, entitled "Epistola de Magnete," which was dated from the trenches of Lucera, in southern Italy, Aug. 8, 1269.

The author was what would be called to-day a military engineer, one who outside of his warlike duties, found time to investigate the properties of the lodestone by numberless experiments. His treatment was so systematic and thorough that little was added to the philosophy of the lodestone for more than three centuries until Gilbert had toiled over his magnetic theory for some twenty years in his workshop in the quaint Essex town of Colchester.

Pierre de Maricourt is frequently referred to as Petrus Peregrinus, or simply Peregrinus (the Pilgrim), probably from his having taken part in one of the crusading expeditions of the time.

In expounding "The Principal Facts Relating to the Earth's Magnetism" a writer of eminence says that Peregrinus does not explicitly state the fact that "like poles repel each other." This nevertheless is what appears in Chapter VI of the "Epistola": "Should you bring the

north pole of one lodestone near the north pole of another, the one you hold in your hand will seem to put the floating one to flight. If the south pole of one is brought near to the south pole of another, the same will happen. This is because the north pole of one seeks the south pole of the other and, therefore, repels the north pole."

Surely, this is a clear, unequivocal description of the repulsion that takes place between the similar poles of a lodestone or magnet.

Again, in the textbook on physics already referred to, the reader is informed that magnetic declination was known as early as the thirteenth century. No authority is given for this statement and none could be given except that of Peregrinus himself, who was the only writer on magnetism of the thirteenth century. An examination of his "Epistola" shows that he believed firmly in the fidelity of the magnet to the pole, for in Chapter V he says: "When a lodestone is placed within a floating basin it will turn the basin round until its north pole lies in the direction of the north pole of the heavens and the south pole of the stone points to the south pole of the heavens." No such thing as magnetic declination was known to Peregrinus, to his contemporaries, or to his successors for a period of 200 years. It is true that a passage was found in the manuscript copy of the "Epistola" which is preserved in the university town of Leyden and which states that at the time and place of writing the needle declined 5 deg. east of north.

There are twenty-eight manuscript copies of the "Epistola" preserved in European libraries, and in none of them is the "declination" passage found save in the one kept in Leyden—a very significant fact indeed. A critical examination of the manuscript by competent authority was naturally called for, and when this was made the passage referred to was shown to be an interpolation in the manuscript made sometime in the early part of the sixteenth century.

The earliest record which we have of magnetic declination on *land* is that made by Hartmann in Rome in 1510 and described by him in a letter written to a Prussian nobleman in 1544, which letter remained practically unknown to the world until it was published in 1831.

Dr. Hellmann, of Berlin, found a few years ago ("Rara Magnetica," 1906) an earlier recognition of this magnetic element on a pocket sun-dial fitted with a compass on the face of which the declination was indicated. The instrument bears date 1451 and was probably made in Nuremberg, the home of the sun-dial makers. This curio may be seen in Innspruck, where it is kept in the Museum Ferdinandeum.

The discovery of magnetic declination on *sea*—the variation of the compass—was made in 1492 by Columbus, who further discovered and recorded its change with change of place, two observations of fundamental importance in the science of terrestrial magnetism.

In the textbook above quoted Boyle is held to have introduced the term "electricity" into our scientific nomenclature. Boyle was admittedly the first to write an English work on the subject, a work which appeared in 1675 under the title "Experiments and Notes About the Mechanical Origine or Production of Electricity." Previous writers on the subject, few in number, had written their tomes in Latin; and it should be observed that they did not use the noun *electricitas*, but contented themselves with the adjective form in such expressions as *motus electricus*, *corpora electrica*, etc., which adjective form was introduced by Gilbert and used by him in his monumental work, "De Magnete."

In 1650, that is a quarter of a century before the publication of Boyle's tract, the English term was used by Charleton in his translation from the Latin of Van Helmont's famous "Ternerary of Paradoxes." The passage reads: "The phansy of amber delights to allect strawes, chaffe and other festucous bodies by an attraction, we confesse, obscure and weake enough yet sufficiently manifest and strong to attest an *electricity*."

But we may go back further still; for in Sir Thomas Browne's "Psuedodoxia Epidemica," which was published in 1646, the term occurs in the singular number on page 51, where appears the statement: "The concretion of ice will not endure a dry attrition without liquation; for if it be rubbed long with a cloth it melteth, but crystal will calefy into *electricity*, that is a power to attract strawes or light bodies."

A few pages further on (page 79) the term is used in the plural number in a paragraph in which it is said of certain kinds of salts such as sal gemma, alum and talc that "if gently warmed at the fire and wiped with a dry cloth, they will better discover their *electricities*."

So to the London physician rather than to the philosopher of Lismore must be given whatever credit may be due for the coinage of the English term "electricity" and for its first use in print in the year 1646.

It is a notable fact that though Gilbert in 1600 added greatly to our knowledge of electrical phenomena, he failed to detect electrical repulsion because he likewise failed to detect electrical insulation. Not a few writers inform us that this fundamental property of electrified bodies was first described by Otto von Guericke in his "Experimenta Nova," published in 1672. But this again is incorrect, for this repulsion did not escape the keen eye of Cabeo, professor of natural philosophy in the schools of Ferrara. That Italian Jesuit describes the phenomenon very minutely in his "Philosophia Magnetica," which was published in 1629. On page 194 of that ponderous volume he notes how iron filings and grains of sawdust are first attracted by an electrified body and then suddenly and violently repelled to a distance of three or four finger-breadths. "Repellantur procul ad distantiam trium aut quattuor digitorum" are his words.

The last instance of inaccuracy here to be noticed refers to current electricity. That there should be some connection between electric and magnetic phenomena was suspected soon after the invention of the Voltaic pile in 1800. In 1802 Romagnosi, a physician of Trent in the Tyrol, thought that he had detected the mysterious relationship, as did also Mojon, professor of chemistry in Genoa in 1804. It is known, too, that as early as 1807 Oersted of Copenhagen had the matter well in mind; but it was not, however, until the summer of 1820 that he succeeded in making the experiment which brought him world-wide fame.

In the textbook referred to the year 1819 is given as the one in which the cardinal discovery in electromagnetism was made. It is true that the Danish physicist, while lecturing on "electricity, galvanism and magnetism" in the university during the winter of 1819, attempted experiments on the subject which he has the candor to say were not "sufficiently conclusive." He missed the effect in 1819, because he placed the wire conveying the current athwart the magnet and un-philosopher-like contented himself with his failure. Some time later, however, having at his disposal a powerful battery of twenty "troughs," he returned to the experiment, when, on stretching the wire lengthwise over the magnet, the response of the latter to the energy of the passing current was prompt and decisive. This was on July 21, 1820.

Realizing the theoretical importance of his discovery, Oersted lost no time in informing the academies and learned societies of Europe of his good fortune. The Latin memoir of four pages in which he describes the experiment was dated July 21, 1820, the day on which the discovery was made. The year 1820, and not 1819, must therefore be taken, in accordance with accepted usage, as that of the discovery of the magnetic effect of the electric current.

Brother Potamian.

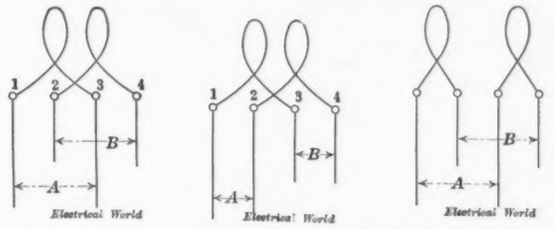
Manhattan College, New York City.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Two-Phase Motor Connections

Fig 1 illustrates the order in which the internal phase-coil leads of many two-phase induction motors are connected to the motor terminal blocks 1, 2, 3, 4. Here one phase of the supply circuit must be connected to terminal blocks 1 and 3 and the other phase of the supply circuit to terminal blocks 2 and 4. Under this condition, each



FIGS. 1, 2 AND 3—DIAGRAMS OF CONNECTIONS FOR TWO-PHASE MOTORS

phase of the supply circuit may be considered as independently applied to an isolated motor coil. The independent currents reach their maximum values at different times and in different places around the stator, thereby producing the rotating magnetism that causes the rotor to turn. In Fig. 2 the internal motor connections are correct, but supply wires have been brought to the terminal blocks in the wrong order. In Fig. 3 the supply wire connections are correct, but the internal motor leads have been brought to the terminal blocks in the wrong order. In either of the latter cases the result is to superimpose the two-phase displaced supply voltages upon each other in the same circuit, thereby giving a single-phase resultant. The motor would be unable to start, but once started would operate as a single-phase motor. Before connecting a two-phase motor to the supply lines it is well to ring out the terminal blocks; then, assuming the connections to be of the type indicated, the correct supply wire connection can always be obtained.

Overload Due to Lack of Lubrication

A monorail induction motor-driven crane that had been operating continuously for a year or more began to get sluggish in action and its two driving motors were heating so badly that it was necessary to favor them. The crane was starting on the third and fourth notch, whereas it ordinarily started promptly on the first notch, and the maximum speed had decreased so much that production was impaired. Heating of the rotor rheostats suggested resistance trouble, but inspection and test of the rheostats showed them to be free from fault. Apparently hot rotors suggested that they were rubbing the stators, but the air-gap gage soon disproved this diagnosis. Application of two voltmeters and of two ammeters showed that the voltage at the motors was normal and that all voltages and currents were balanced, but that the motors were much overloaded. It was improbable that there should be anything wrong with the motor connections or windings, for the ammeters would have shown unbalancing. Furthermore, the chances of the two motors being similarly defective electrically were small, especially in the light of their having operated smoothly for so long a time.

The inspector was nonplused and was inclined to give up for the night, and to resume the investigation the next morning, when the mill foreman, passing on his way out, called to the crane man, who, it seems, had been on the job for only two days, to be sure to oil his crane before he went home. "Sure," said the crane man, who then turned to the inspector and sought information as to the location of the crane parts that should be oiled. This was indeed a welcome clew to the inspector, who immediately set to work and found that all of the bearings on the crane were as dry as a bone and that the only reason that they had not run babbitt was that they were made of brass. Fifteen minutes after oiling the bearings, which had had no oil for three days, operation was almost normal and the crane went freely through a curve through which it could not pull previous to the oiling. In an hour the inspector withdrew, a sadder but a wiser man—wiser because he realized that the best way to ascertain whether or not a piece of machinery has been oiled is to look.

Alarm-Clock Control for Street Lighting

The street lighting of the little city of Leetonia, Ohio, is controlled by a home-made time switch, the principle of which is shown in the accompanying sketch. The alarm clock in the upper right-hand corner of the drawing operates the entire mechanism. A circular piece of metal soldered to the alarm-winding key wraps the heavy cord about it as the alarm rings and, with the knife switch acting as a lever, withdraws the sliding bar from beneath the weight, allow-

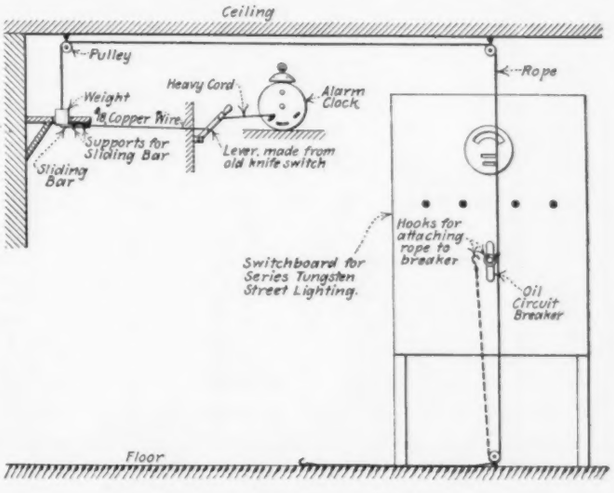


DIAGRAM OF ALARM-CLOCK CONTROL

ing the latter to drop. Falling through the opening in the supporting platform, the weight jerks the rope and trips out the breaker. If it is desired to light the lamps with the same time switch it is necessary only to attach the hook shown in dotted lines to the breaker and the action of the clock at the appointed time closes the switch.

In the early part of each day, when Mr. E. H. Geithel-

man, who acts as superintendent, contract agent and chief engineer for the company, visits the station, he winds the clock and sets the alarm at the proper hour for switching the lamps into the circuit. It is then necessary only to make another trip to reverse the hooks and reset the alarm for extinguishing the lamps at daybreak.

Power-Plant Repair Complaint and Work-Order Blanks

A simple yet comprehensive method of reporting complaints on defective power-plant machinery, assigning jobs to workmen and tabulating the costs of labor and material required for repairs is in use by the Louisville (Ky.) Gas & Electric Company. In many plants where defective conditions are reported verbally to the operating engineer, delay often ensues either because the matter slips someone's memory or because the complaints failed to state the extent of the repair work required. Mr. A. F. Wilson, operating engineer of the Louisville company's Waterside station, makes use of two forms of reports printed on cardboard 3.25 in. wide and 7 in. long. The station complaint report is a red card and the work-order report is white. Copies of each are shown in the accompanying reproductions. A stock of the complaint cards is kept at the place where the men fill out their time slips so that they will not be delayed in looking for the cards.

On one side of the complaint card blanks are left for filling out the name of the apparatus needing attention, its location, condition, and the work and material required for its repair. On the reverse side are spaces for filling in the work order issued, when the work is completed, and the cost

No.....
WORK ORDER ISSUED

Time.....M. Date.....191.
To.....
Nature of Order.....
.....
.....
.....

Work Completed

Time.....M. Date.....191.
By.....
Remarks.....
.....
.....
.....

Cost

Total Labor $.....
Total Material .....
Total Cost $.....
Charged.....
.....
.....
.....
.....
By.....
Clerk
.....
Form 114 M-11-12

STATION COMPLAINT
Kentucky Electric Co.
Louisville

The Company will appreciate any suggestions made by its employees with a view of improving the service. All defective apparatus must be reported at once. Use this card. Do not write on the back.

To Operating Engineer: The machine, apparatus or part described below is in bad order and requires repairs or changes as follows:

Apparatus.....
Station No.....
Part.....
.....
Condition.....
.....
.....
.....
.....
Work Necessary, Material Required
.....
.....
.....
.....
.....
.....
Signed.....
Time.....M. Date.....191.
Noted .....
Operating Engineer

FIG. 1—FRONT AND BACK OF STATION COMPLAINT BLANK

of making the repair is summarized under labor and material. As these cards are filled out the clerk in the office collects them from a drop box, makes a note of their receipt in his journal, and turns them over to the operating engineer, who fills out a station work order blank and has it placed in the hands of the foreman in charge of the men familiar with such work.

On the front of the work-order blank is entered the name of the man in charge of the job, followed by a detailed account of the work to be done. On the reverse side the foreman fills out the names of the men employed on the job, and the amount of time which each man works. In addition to this, a detailed list of material used is recorded.

STATION WORK ORDER
Kentucky Electric Co.

Louisville, Ky

To .....
Do the following described work:
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
Charge to Order No.....
When Required.....
Signed.....
Operating Engineer
Time.....M. Date.....191.

No.....
WORK COMPLETED

Name of Men	Hrs.	Rate	Tot.
Material			
Total Cost			

Remarks.....
.....
Signed.....
Time.....M. Date. .....191..
Approved.....
Form 115. M-11-12.

FIG. 2—FRONT AND BACK OF STATION WORK ORDER

This card is returned to the clerk on completion of the job, and the rate paid each man, the total amount due to him and the cost of the material used are all entered in their respective places.

Safety Soldering Ladles

Burned fingers seldom incapacitate workmen, but such injuries reduce efficiency and if left unattended may lead to serious results from infection. In the departments of one large manufacturing plant where a great deal of soldering of coils and cummutator leads is done accidents have been reduced to a minimum by the introduction of non-

SAFETY SOLDERING LADLES

splashing ladles for pouring the solder. As shown in the illustrations, these safety ladles consist of the regular stock ladles with an additional rim or a pouring nozzle. A further practical advantage gained by the use of such ladles is that all solder is poured from the bottom so that the slag which floats on the molten metal does not interfere with the work.

Comparative Costs of Operating Ice Factory by Oil Engines and Electric Motors

BY C. E. ROSE

The plant of the Arkansas Cold Storage Company, at Little Rock, Ark., produces refrigeration for a cold-storage warehouse of 100,000 cu. ft. capacity, a street pipe-line of 42,000 cu. ft. capacity and two freezing tanks, each having an output of 40 tons of raw-water ice per day. The refrigerating machinery consists of two vertical duplex Frick gas pumps each rated at 50 tons of refrigeration per twenty-four-hour day when running at 77 r.p.m. with standard refrigerator and condenser pressures. In addition to this equipment, 100 hp is installed in various motor units of from 2 hp to 25 hp, used to drive the circulating-water and brine pumps, air compressors, agitators, etc.

Ice is made by the raw-water system, using artesian water purified by being passed through two quartz filters and one paper filter. Very clear ice results therefrom, as the accompanying illustration of a cake shows. A pressure of 2 lb. per sq. in. is carried on the air-agitation lines in the ice cans, and each 300-lb. can requires 1 cu. ft. of free air per minute to produce the best results.

INITIAL USE OF OIL ENGINES

There were first installed in this plant two 120-hp vertical, three-cylinder Diesel oil engines, but much trouble was experienced from these units gradually and continually dropping their load when most needed. The travel of the fuel valves on the engines was very small and a very slight wear was found to produce a marked effect in the power of the engines. For best results the valves should be set so that the explosion takes place with a "lead" adjustment of 6 in. on the circumference of the flywheel; but unless the Little Rock engines were checked continuously it was found that they would shortly be operating with a "lag" and consequent loss in compression and in power. Again, many small shutdowns were required owing to the crystallization of valve-rod springs and safety-valve springs and to similar small troubles. Much difficulty was also experienced with the three-stage, high-pressure air compressors, the trouble being principally with the rubber ferrules in the first and second receivers, since at the high

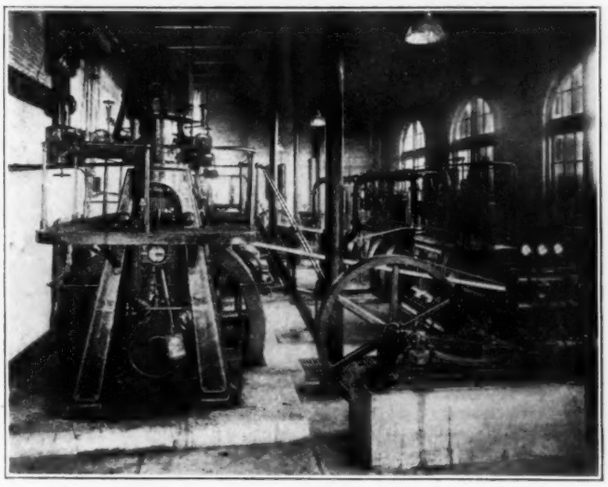


FIG. 1—REFRIGERATING MACHINES DRIVEN BY OIL ENGINES

pressures used (300 lb. to 600 lb. per sq. in.) the rubber deteriorated and deformed very rapidly.

A view of the engine room is presented herewith in Fig. 1, showing the oil-engine installation, which required five men for its operation and maintenance with both engines running fully loaded twenty-four hours a day.

In Fig. 2 is shown a similar view of the same plant following replacement of the engines with two 100-hp adjustable-speed, 2200-volt induction motors. With this adjustable-speed control a very even time-temperature curve is maintained on the freezing tanks, in the warehouse and on the street pipe-line, whereas with the former practically constant-speed oil engines it was necessary to run at full speed or stop, and the time-temperature curves presented continually rising or descending slopes.

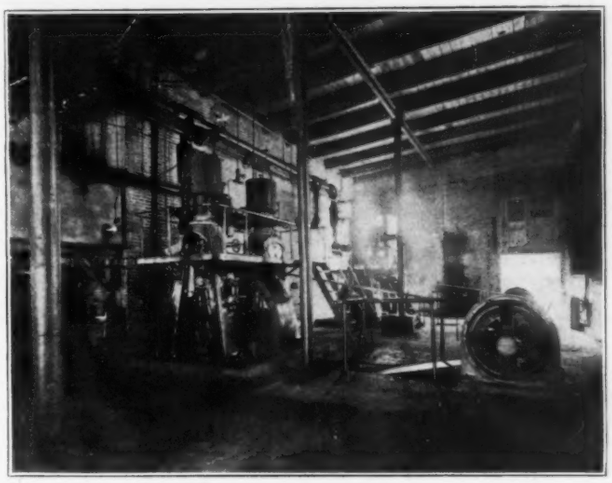


FIG. 2—SAME AMMONIA COMPRESSORS OPERATED BY ELECTRIC MOTORS

In the following discussion all figures are based on the unit "ton of refrigeration," which represents the abstraction of 284,000 lb.-Fahr. thermal units. All unit costs and revenues are calculated, therefore, with tons of refrigeration as the units of manufacture.

Each oil engine, in addition to being belted to one ice machine, was arranged to drive through another belt from the opposite flywheel a three-phase alternating-current generator, which supplied 240-volt, three-phase, 60-cycle energy for the operation of the auxiliary motors. The actual electric load was thus 38 kw.

COMPARISON OF OPERATING COSTS

For the year ended Oct. 1, 1912, during which oil-engine drive was used, the books of the company showed the following:

Tons of refrigeration manufactured	13,123
Kilowatt-hours produced	497,608
Kilowatt-hours per ton of refrigeration	37.9
Fuel oil for power, per ton of refrigeration	$0.124
Wages for power per ton of refrigeration	0.170
Lubricating oil and waste per ton of refrigeration	0.074
Water per ton of refrigeration	0.030
Electricity purchased per ton of refrigeration	0.012
Maintenance of oil engines per ton of refrigeration	0.013
Maintenance of refrigerating plant per ton of refrigeration	0.008
Maintenance of electric equipment per ton of refrigeration	0.013
Maintenance of auxiliary equipment (pumps, air compressors, etc.) per ton of refrigeration	0.007
Total engine-room expense per ton of refrigeration	$0.451

Not enough refrigeration was produced, however, to handle satisfactorily the company's business, and it was imperative that some drastic change be made. The Merchants' Lighting Company, of Little Rock, proposed that the Arkansas Cold Storage Company replace its two oil engines with 100-hp adjustable-speed motors. The central station also offered its regular primary rate of $1 per kw of maximum demand plus an energy charge of 1 cent net per kw-hr. for the electricity consumed by the motors, provided that the refrigerating plant would not run during the company's peak load. The cold-storage company, after carefully considering the terms of the offer, accepted the proposition of the lighting company and installed the

motors as suggested, selling the oil engines at a very fair price.

Following is the statement of operation of the Arkansas Cold Storage Company's engine room for the year ended Oct. 1, 1913, during which period electric-motor drive was employed:

Tons of refrigeration manufactured	19,899
Kilowatt hours	750,401
Kilowatt-hours per ton of refrigeration	38
Wages for power per ton of refrigeration	$0.106
Lubricating oil and waste per ton of refrigeration	0.030
Electricity purchased per ton of refrigeration	0.235
Water per ton of refrigeration	0.005
Maintenance of electric plant per ton of refrigeration	0.010
Maintenance of refrigerating plant per ton of refrigeration	0.035
Maintenance of auxiliary equipment per ton of refrigeration	0.024
Total engine-room expense per ton of refrigeration	$0.445

Comparison with the preceding figures for oil-engine drive shows a decrease of 6 mills per ton in favor of electric operation. Incidentally, however, the tons of refrigeration manufactured by the company were increased 50 per cent, and the warehouse and pipe line were maintained without complaint or trouble. During even the hottest days of summer 40 tons of clear marketable ice was produced without difficulty.

The figures for the total kilowatt-hours manufactured in the case of the oil-engine equipment were calculated from

FIG. 3—CAKES OF RAW-WATER ICE

weekly indications of the ice machines and from the kilowatt-hour output generated by the small alternators carrying the electrical load.

Advantages Resulting from Electrical Drive

Even in the days of engine drive it was necessary to have central-station service in the building at all times, for it not infrequently happened that both oil engines would be shut down for a few minutes at the same time. The circulation of the brine through the pipe line and brine coolers could never be permitted to stop, as sufficient time would not be allowed to pump out the liquid ammonia in the brine coolers, and such ammonia, if not pumped out, would continue to boil, freezing up the brine in the coolers and finally bursting them.

Again, each engine shut-down caused a temporary suspension of the air pressure on the freezing tanks, resulting in a consequent white line in the ice. Interruptions for even five minutes would completely ruin cakes of ice which were just beginning to freeze, since the white line would then be near the outside of the block, causing the entire cake to have a white, opaque appearance.

The costs tabulated above represent the manufacturing expense in the engine room; but, owing to the larger divisor of units manufactured, the total cost (including the above and the general expenses and fixed charges) for the oil-engine equipment amounted to $1.22 per ton of refrigeration. With electric drive these charges were but $0.956 per ton, a saving of $0.264 per ton of refrigeration over the oil-engine figures.

During the first year the Arkansas Cold Storage Company paid expenses, fixed charges and but very little more. With the electric drive, however, it earned for the year ended Oct. 1, 1913, an 8 per cent dividend and also passed several thousand dollars to surplus.

The increase in refrigeration capacity was obtained by speeding up the ice machines from 77 r.p.m. to 116 r.p.m. Some of the operators declared that on account of the high speed very little would be gained in weight of ammonia compressed in a given time. Indicator cards have, however, shown that while at this high speed of 116 r.p.m. the area of the card is slightly reduced, there occurs nothing like the increase in volumetric displacement of the machine in a given time. The net gain in refrigerating capacity was 24 tons per day, giving the plant a rating of 148 tons of refrigeration, and not 100 tons as with the oil-engine equipment at its best condition.

Universal Motor

I have a window display to drive which requires a motor of from 0.0625-hp to 0.0833-hp rating. I wish to put several of these equipments on tour in the larger cities of the United States where both alternating and direct current are used for lighting. After some correspondence with one manufacturer of alternating-current and direct-current motors such as are used for vacuum cleaners, he refuses to guarantee the satisfactory operation of his motors when changed from direct to alternating current. Would you advise the use of two independent motors, space and weight being important factors? C. A. S.

For the use described you should have no difficulty in finding a "universal" motor which will operate satisfactorily on both alternating and direct current. Such motors are usually of the series type, and while operating directly across the alternating-current circuit, are arranged to have a fixed resistance cut in series when running on direct current. Universal motors are in satisfactory operation even in the largest sizes. We know of one crane installation equipped with 15-hp motors which is in use in a shop having its own direct-current generating equipment but purchasing alternating-current central-station energy from outside. As a result of the peculiar load conditions this motor is operated by direct current during the hours the private plant is running and is then transferred to the alternating-current mains during the peak hours, as well as for overtime service.

Lightning Troubles at Generators

During the last three years we have been operating a waterwheel driven alternator and have experienced much trouble from lightning. This season, for instance, several generator coils were burned out. Prior to 1910, however, we had in use a belt-driven machine and were never troubled with lightning beyond the blowing of a few fuses on the transformers. Is there any evidence that direct-connected waterwheel plants are more subject to lightning disturbances than belt-driven machines? H. E. O.

We think your increase in lightning troubles—if not due to the especially severe disturbances of the past season as experienced in some sections—must be traced to a difference in line conditions, arrangement of your lightning protection or characteristics of the windings of the waterwheel generator as compared with those of the belted machine. In any case the frame of a belted generator would, for practical purposes, doubtless be as effectually grounded, either intentionally or accidentally, as would that of a direct-connected waterwheel unit, so that this factor should not be held accountable for the damage. Perhaps the dry weather of the past season removed most of the moisture from the sand and gravel ground connections of your lightning arresters, thereby invalidating the customary discharge paths.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Direct-Current Machines with Interpoles. — OSKAR SZILAS.—Although interpole machines are now being generally used, faulty operation sometimes occurs in practice as the result of wrong positions of the brushes or wrong connections of the interpole windings. The author describes in detail a great many experimental methods and "kinks" by which the correct operation of such interpole machines may be assured. He points out that the important object is to determine the exact location of the neutral zone. The operation of the machine will be faulty if even a small error is made in the position of the brushes. The author then shows why for the determination of the neutral zone the method of voltage maximum is not sufficient, and describes a more satisfactory method as follows: The direct-current machine is driven as a dynamo without load, at constant speed and excitation. Two auxiliary brushes, separated by a distance of 3 mm to 4 mm from each other and connected to a voltmeter with a 3-volt scale, are moved on the commutator in a tangential direction until the voltmeter reading is zero. The same distance must always be maintained between the auxiliary brushes; the position of the auxiliary brushes, which corresponds to the zero reading of the voltmeter, will then indicate the neutral zone. An important condition for the correct use of this method is that the machine be producing no current. For instance, the test could not be used for unloaded motors, since the interpole flux due to the no-load current would cause the zero reading of the voltmeter to occur outside of the neutral zone. The method is entirely correct only if the regular brushes of the machine be taken off the commutator. After the neutral zone has been fixed it is important to determine experimentally the quality of commutation under different conditions. Various methods are described for accomplishing this purpose.—*Elek. u. Masch.* (Vienna), Nov. 9, 1913.

Amortisseurs.—P. BOUCHEROT.—The first part of a long and highly mathematical paper giving theories of the damping of the oscillations of alternators operating in parallel and of the use of amortisseurs (damping coils). The author begins with the elementary condition of parallel operation of two alternators and applies it to the case of very long oscillations—long enough to permit neglecting the amplitudes of the emfs, while considering only the phase. He then gives the complete theory for the oscillations corresponding to any frequency occurring in practice, taking into account variations of speed and of the induced currents in the amortisseurs and in the primary circuits. The calculation is made in two steps, first, under certain simplifying assumptions, and later in more rigorous form. The paper is to be concluded.—*La Lumière Elec.*, Nov. 8, 1913.

Self-Excitation of Saturated Polyphase Commutator-Type Series Machines.—A. SCHERBIUS AND H. A. W. KLINKHAMER.—In discussing means for suppressing the self-excitation of polyphase commutator-type series motors two actions must be taken into consideration. The first is the effect which the saturation in one axis of the machine has on the other axis by purely magnetic action. The second is the effect of one saturation axis on the other due to magnetic flux superposition. The first effect has been investigated in detail by Binder and Dyhr, who have developed a simple formula for the value of the protective resistances. The present authors emphasize the point that it is sufficient to take care of only one of these two effects, and they therefore deal in detail with the second effect mentioned. Another formula is derived which represents the required condition for suppressing the self-excitation. Protective resistances calculated from this formula have smaller values than those computed with the formula of Binder and Dyhr.—*Elek. Zeit.*, Nov. 20, 1913.

Winding Diagrams.—G. MOORES.—An article, illustrated by diagrams, in which the author shows that alternating-current winding diagrams may be made much simpler and more useful for practical shop purposes than at present through the extended use of the "group" type of diagram. The methods of using and constructing these diagrams are described, together with a discussion of their advantages.—London *Elec. Review*, Nov. 21, 1913.

Theory of Alternators.—JOHANN LISNER.—The first part of a highly theoretical paper on the theory of alternating-current machines without commutators.—*Elek. u. Masch.* (Vienna), Nov. 23, 1913.

Measuring Phase Difference in Synchronous Machines.—W. TOLWINSKI.—An article illustrated by diagrams describing a stroboscopic method for measuring the phase angle between the voltage at the terminals and the induced emf in synchronous machines.—*Elek. u. Masch.* (Vienna), Nov. 23, 1913.

Insulation of Electromagnet Coils.—B. DUSCHNITZ.—An illustrated review of methods of insulating magnet coils to render them unaffected by high temperatures.—*Elek. Zeit.*, Nov. 20, 1913.

Lamps and Lighting

German Tungsten Lamp Patents.—After protracted proceedings, extending over two or three years, the German Patent Office has decided definitely, despite the opposition of sixteen firms, in favor of the fundamental patent for drawing tungsten wire for metallic-filament lamps. It will be remembered that the General Electric Company of the United States, after experiments which were spread over a period of years, succeeded in devising the particular system whereby it was possible to draw tungsten wire of a convenient thickness, or rather thinness, for lamp filaments. As a result of the interchange arrangements existing between the General Electric Company and the Allgemeine Elektricitäts Gesellschaft of Berlin, the German patents for the new process were vested by the former in the latter, and the special agreements between the two companies permitted of the patent rights also being exercised by the Siemens & Halske Company and the German Incandescent (Welsbach) Gas Light Company, while the Bergmann Company was subsequently also brought within the field by the grant of a license. As the Patent Office has now given a decision in regard to the patents, these four firms will likely benefit from the result. On the other hand, other concerns have not been slow in coming forward to declare that they are not affected by the action of the Patent Office. The Julius Pintsch Company, for instance, states that the decision is of no importance in the case of Sirius lamps, which are made according to the company's own patented process. Voigtlander & Lohmann point out that any firms are permitted to manufacture incandescent lamps with tungsten wire as long as the wire is not made on the basis of the patent to which the de-

cision refers but is produced by some other method.—London *Elec. Review,* Nov. 21, 1913.

Metallic Filaments.—A note on a recent British patent (No. 19,006, 1912) of H. Kast. Metals and metallic oxides are obtained in a minutely divided state by heating the metallic salts of the nitro-phenols until the metal or oxide separates itself. Before heating the salts may be diluted with indifferent substances or mixed with oils, fats, tars, etc.—London *Elec. Eng'ing,* Nov. 20, 1913.

Generation, Transmission and Distribution

Electricity as a By-product.—R. J. Spencer-Phillips.—A paper read before the (British) Institution of Municipal Engineers. The author endeavors to show that other interests besides central-station companies may find it profitable to sell electricity, especially mills which need electric power for their own purposes and by erecting a larger plant can run more economically and sell their surplus energy as a by-product at a profit. An added reason lies in the recent development of back-pressure and reducing turbines. The author thinks that mills and factories, especially those that require steam for their own processes, are in a position to generate electricity much cheaper than are central stations. The same subject is also discussed in a long editorial—London *Electrician,* Nov. 21, 1913.

Pressure Rises.—W. Duddell.—An abstract of an experimental lecture given before the (British) Institution of Electrical Engineers. The author first discusses the pressure rises due to resonance and shows that resonance at the fundamental frequency is rare but very dangerous when it does occur. Resonance of an upper harmonic is much more frequently observed, but with the good wave-forms of modern turbo-alternators the amplitudes of the upper harmonics are so slight that their resonance does not generally produce any dangerous pressure rises. The author then takes up pressure rises due to switching and to arcs and sparks.—London *Electrician,* Nov. 21, 1913.

Traction

Single-Phase Traction.—A continuation of the long illustrated description of the Spiez-Brig (Loetschberg tunnel) railroad. In the present instalment detailed drawings are given of the electric locomotives and electrical connections, with data on the controller equipment, etc. The normal pressure at the trolley wire is 15,000 volts, the frequency is 15 cycles per second, and the maximum grade is 2.7 per cent. The total length of each locomotive is 16 m and the total weight is 107 tons, of which the mechanical part weighs 47.3 tons and the electrical part 59 tons. The adhesion weight is 78.2 tons. The rating for continuous operation for an hour and a half is 2500 hp at a speed of 50 km (30 miles) per hour. The maximum speed is 75 km (45 miles) per hour and the maximum starting effort is 18,000 kg.—*Elek. Zeit.,* Nov. 20, 1913.

Starting Traction Motors.—Conrad Iranyi.—An article illustrated by diagrams in which the author emphasizes the troubles due to rapid starting of traction motors and shows graphically the advantages of maintaining certain time intervals between the different starting steps.—*Elek. Zeit.,* Nov. 20, 1913.

Wires, Wiring and Conduits

High-Tension Insulators.—F. W. Curt Brecht.—An illustrated article on the evolution of American high-tension insulators in their electrical, mechanical and commercial aspects.—*Elek. u. Masch.* (Vienna), Nov. 23, 1913.

Electrophysics and Magnetism

Roentgen-Ray Interference Phenomena.—M. von Laue and W. Friedrich.—Two papers read before the annual convention of German Naturalists and Physicians. Laue discussed the general principles of Roentgen-ray interference with respect to recent experimental investigations and pointed out how conclusions may be drawn from these phenomena concerning the structure of crystals. Friedrich outlined conceptions, based upon similar interference phenomena, as to the Roentgen rays themselves, their spectrum and their wave-length.—*Phys. Zeit.,* Nov. 15, 1913.

Electrochemistry and Batteries

Storage-Battery Plates.—A note on the method of H. T. Hannover for the production of porous storage-battery plates. The process is based upon the fact that the predominating metal in an alloy solidifies first and leaves the eutectic disseminated for a time in liquid form throughout the mass. Conversely, during reheating, the eutectic melts first and may be removed by centrifugal force or other means, thus leaving a honeycombed mass of metal of high porosity. The lead-antimony eutectic contains 13 per cent antimony and 87 per cent lead, so that in a 96 per cent lead alloy 27 per cent of the lead will go to form the eutectic, which solidifies at about 228 deg. C. The small percentage of antimony remaining in the lead matrix after expulsion of the molten eutectic is said not to affect the electrochemical capacity of the plates, but appreciably increases their strength. After trying various other methods, Hannover found that the best method of expelling the eutectic is by whirling. Cakes of the alloy are mounted in suitable frames carried by the arm of a whirling machine, and the discharge side of the plate is covered by gauze backed by a grating. To prevent cracking of the surface of the plate, it is necessary to tighten up the mold clamps as the eutectic is expelled. This adjustment is effected by the link work shown in Fig. 1 and actuated by a hand wheel on the spindle. If the molds be filled while in the whirling machine, with a view to expelling the eutectic during cooling instead of after reheating, the molten metal runs through the gauze, but it should be possible to overcome this difficulty. Tests made in the shops of the Danish State Railways on Planté plates prepared by this process show the maximum safe charge and discharge rates to be increased considerably, making the Hannover plates especially suitable for automobile and submarine use. It is easy to prepare plates of more than 50 per cent porosity by the above means, and assuming the number of pores to average 13,000 per square inch (as found by microscopical examination) and to be of circular section and perpendicular to the surface of the plate, the total surface of the latter is about 130 times its natural superficial area in the case of a plate 5.5 in. by 3.25 in. by 0.25 in. Though porous metals prepared by the Hannover process have been applied only to the manufacture of accumulators as yet, it is hoped that they will also prove applicable to metallic filters, self-oiling (honeycomb) bearings, catalyzers, soldering sticks and various classes of ornamental work.—London *Elec. Review,* Nov. 21, 1913.

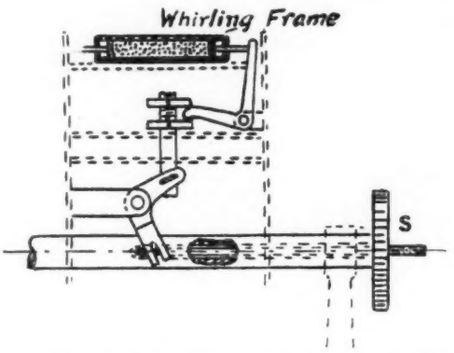


FIG. 1—APPARATUS FOR PRODUCING POROUS ACCUMULATOR PLATES

Zinc.—A symposium of papers on the present status and future prospects of the metallurgy of zinc. G. C. Stone discussed the development of the retort process and gave details of the great progress made in recent years. W. R. Ingalls discussed electric zinc smelting, which he said is

still much in its infancy. J. W. Richards discussed electrolytic zinc. In the discussion W. McA. Johnson spoke of the progress made by him in electric zinc smelting.—*Metal. and Chem. Eng'ing,* December, 1913.

Electric Furnaces.—WOOLSEY MCA. JOHNSON AND GEORGE N. SIEGER.—In the present instalment of this illustrated serial on electric furnaces, their design, characteristics and commercial applications, the authors deal with the subjects of buildings for an electric-furnace plant, foundations for electric furnaces, electrical connections and voltage regulation, essentials of electric-furnace transformers, and construction of water rheostats.—*Metal. and Chem. Eng'ing,* December, 1913.

Electric Ore-Reduction Furnace.—F. LOUVRIER.—An illustrated description of an electric furnace of the resistor type in which the furnace charge forms the resistor. The electrodes are embedded in the side walls opposite each other, being arranged in several sets one above another. Temperature regulation is obtained by switching on or off sets of electrodes. The applications of this furnace to the reduction of iron ores and the treatment of lead ores, and especially to the reduction of zinc ores, are described.—*Metal. and Chem. Eng'ing,* December, 1913.

Passivity of Metals.—An account of a symposium of papers delivered before the Faraday Society on the passive state of metals. A paper by G. Senter presented an introduction to the theory of the passive state of metals. G. Grube discussed anodic and cathodic retardation phenomena; D. Reichinstein discussed the electrode-volume constant-sum hypothesis; H. S. Allen photoelectricity and passivity; M. LeBlanc passivity and reaction velocity; G. S. Schmidt the hydrogen theory of passivity; E. P. Schoch the anodic oxygen-film and oxide-film hypothesis, and G. Schulze passivity and electrolytic valve action.—*Metal. and Chem. Eng'ing,* December, 1913.

Units, Measurements and Instruments

Astatic Electro-Dynamometers.—J. T. IRWIN.—A note on a recent British patent (No. 27,348, 1912). Two coils on the horizontal axis are so connected that the fluxes oppose. In the resulting radial flux is mounted a coil with its center on the axis of the two coils and with its plane vertical and free to rotate about a vertical axis. This coil is wound so that the currents pass the same way up the sides and down at the center. The torque can be measured in any well-known way.—London *Elec. Eng'ing,* Nov. 20, 1913.

Watt-Hour Meters.—S. H. HOLDEN.—A paper read before the Birmingham Section of the (British) Institution of Electrical Engineers on the British standard specification for consumers' watt-hour meters. The author recommends various modifications to bring these specifications up to date.—London *Electrician,* Nov. 14, 1913.

Laboratory and Testing Room.—LEON LICHTENSTEIN.—An English translation in abstract of his German paper on the laboratory and testing rooms of the Siemens-Schuckert Cable Works.—London *Electrician,* Nov. 14, 1913.

Composite Waves.—K. FISCHER.—An illustrated description of an apparatus which permits the superimposition of one or more higher harmonics upon a sinusoidal wave so that the curve obtained represents the composite wave.—*Elek. Zeit.,* Nov. 13, 1913.

Determination of Radium in Radio-Active Substances.—A. L. FLETCHER.—An illustrated description of a new method which is a modification of that of Strutt. The author employs what he calls a micro-furnace. It consists of a brass drum sliding on a slate cylinder which is perforated from below to allow of the passage of two wires connected to terminals on the upper face of the cylinder. These terminals clamp a thin rod of arc carbon which is heated by the passage of an electric current of about 10 amp per square millimeter of cross-section (maximum). The brass drum which slides on the cylinder may be adjusted in any position and the size of the chamber varied accordingly. This chamber is inclosed above by a plate of glass or transparent silica cemented to a brass frame resting on the rim of the drum. In these experiments the upper rim was lubricated with vaseline and the lower rim covered by a rubber band to prevent leakage. The arrangement of the apparatus is shown in Fig. 2. A small splint-

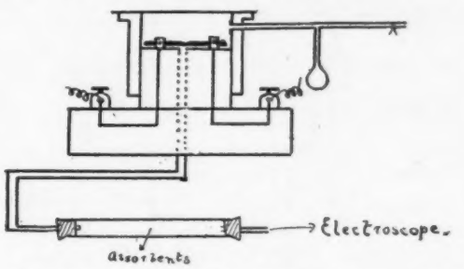


FIG. 2—APPARATUS FOR DETERMINING AMOUNT OF RADIUM IN A SUBSTANCE

ered and weighed fragment of the mineral or salt (say, 0.01 gram to 0.0001 gram) is placed in a hollow in the carbon rod, and the cover glass adjusted. The current is passed through the rod, which is heated to a temperature between 2000 deg. C. and 3000 deg. C., for from ten to thirty seconds. If the mineral decrepitates it should be covered with a fragment of carbon to prevent its escape. The small rubber balloon (about 100 cu. cm capacity) allows for the expansion of the air and the production of carbon dioxide. This latter combined effect is, however, very small. The electroscope, after having been exhausted, refilled and observed, is then again exhausted and filled through the chamber and through calcium chloride, soda-lime, phosphoric oxide and a plug of cotton-wool to absorb the ions generated in the furnace. These tubes require refilling only at long intervals of time. Hence the apparatus is always ready for a determination which may be made completely in from twenty to thirty minutes. A length of capillary tubing is inserted to protect the leaf and to insure uniformity in the rate of filling. The collapse of the leaves is then observed in the usual way.—*Philos. Mag.,* October, 1913.

Telegraphy, Telephony and Signals

Fire Alarms.—An illustrated article on the fire-alarm systems of a German company which makes two types—

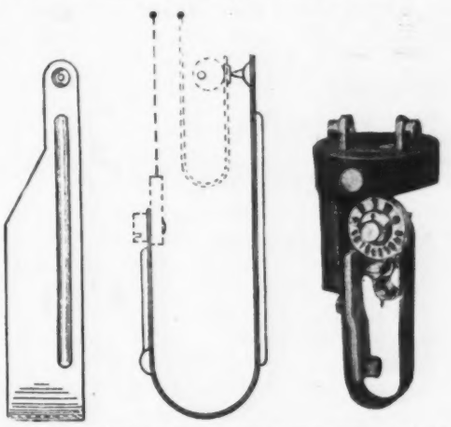


FIG. 3—MAXIMUM-TEMPERATURE FIRE ALARM

maximum-temperature alarms and differential-temperature alarms. The essential part of the maximum type of alarm system is shown in Fig. 3. It consists of a U-shaped piece made of two metal strips welded together but having different coefficients of elongation. When the temperature changes the strip bends so that when a certain maximum temperature is reached a circuit is opened or closed. The

metal strip with the contact device and adjustment wheel is mounted on a frame of insulating material. By means of the adjustment wheel the alarm may be set to any maximum temperature between 40 deg. and 90 deg. C. While this type of alarm operates at a certain maximum temperature the differential type of alarm is independent of a maximum temperature. As shown in Fig. 4, it consists of

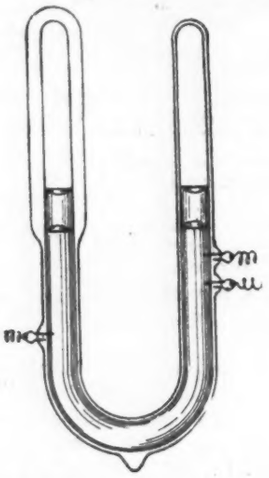


FIG. 4—DIFFERENTIAL-TEMPERATURE FIRE ALARM

a U-formed glass tube both legs of which are half filled with mercury. Above the mercury each leg contains a small quantity of a liquid which evaporates easily. One leg is made of thick glass, the other of thin glass. When the temperature rises quickly the first leg is not heated so rapidly as the second leg so that in the latter the liquid above the mercury evaporates first, producing a vapor pressure which presses the mercury down and interrupts the circuit. This type of alarm is usually furnished in combination with a maximum alarm as above described so that the differential alarm will operate when the temperature rises quickly, while the maximum alarm can be depended upon to detect a slowly developing fire by indicating when a certain maximum temperature has been reached.—*Elek. Zeit.*, Nov. 20, 1913.

Miscellaneous

Commercial German Statistics.—Fasolt.—The conclusion of his article, illustrated by diagrams, on the representation of electrical products in the official German commercial statistics. Diagrams show the development of the electrical export trade of Germany during the past seven years.—*Elek. Zeit.*, Nov. 20, 1913.

Book Reviews

Electrical Engineering for Mechanical and Mining Engineers. By H. J. S. Heather, B.A. London: The *Electrician* Printing & Publishing Company, Ltd. 332 pages, 184 illus. Price, $3.50.

A series of lectures to mechanical and mining engineers in order to introduce the principles of electric energy distribution to their acquaintance. The chapters of the book are well arranged in sequence for the purposes kept in view. The treatment is clear, definite and systematic. The chapters representing the twenty successive lectures relate to the following subjects: The electric circuit, resistance, alternating currents, recapitulation, electric measurements, continuous-current dynamos, continuous-current motors, alternating-current generators, synchronous motors, transformers, polyphase systems, polyphase transformations, induction motors, abnormal conditions. The mathematics in the book is judiciously reduced to the simplest essential formulas. The symbols and notation employed are, however, not up to date; thus C is used to represent current in Ohm's law, whereas all over the world I is now recognized as the international symbol. Probably this will be corrected in subsequent editions. The book should be very serviceable to engineers not well versed in electricity.

Cours d'Électrotechnique Générale et Appliqué. By R. Swyngedauw. Paris: Librairie Polytechnique, Ch. Béranger. 309 pages, 135 illus. Price, 10 francs.

This textbook on the principles and design of direct-current dynamo machines is intended to be followed by a second volume devoted to alternating-current machines. The book has the distinct advantage of presenting at the outset a table of the symbols employed and adhering to this notation throughout the text. Still better would it have been if a corresponding degree of precision had been established and maintained as to the magnitude of the units connoted with each individual symbol. In the text, for example, one finds it not always easy to discover whether the value of electromotive force attaching to some of the equations is expressed in terms of the abvolt or the volt. The same symbol appears for both, without specific distinction. The treatment is clear and well explained, as befits a volume intended for a college textbook, although the subject matter might with advantage be further illustrated by arithmetical examples. The chapters of the book relate to the following topics: Electric currents, electromagnets, emf in a bipolar ring armature, ring-armature windings, drum armature, closed windings on drum armatures, the magnetic circuit of the dynamo, magnetic characteristics, toothed armatures, armature reactions, commutation, mechanical armature reactions, generator characteristics, motor characteristics, constant-potential motors, power and efficiency of dynamos, transmission of power, etc. The book will be useful to students of dynamo-electric design from the electrical point of view.

The Electric-Vehicle Handbook. By H. C. Cushing, Jr., and Frank W. Smith. New York: H. C. Cushing, Jr. 356 pages, 161 illus. Price, $2.

Unusual care has been taken to insure the completeness of this useful treatise on the operation and maintenance of electric vehicles. Passing from an adequate discussion of the subjects of batteries, motors, controllers and other parts of the car proper, a number of the pages of the work have wisely been devoted by the authors to charging apparatus, rectifiers, motor-generator and converter sets, instruments, meters, charging resistors, etc. Logically conceding that the uninformed vehicle operator should give the greatest care and attention to his storage battery, the section devoted to this important subject appropriately occupies the first pages of the book. Both lead-sulphuric-acid and nickel-iron-alkaline cells are described and illustrated, with complete discussions of their respective characteristics in service. Following the section on batteries logically comes material describing charging methods, with a discussion also of the special applications of each type of equipment to the duty imposed. The chapter on measuring instruments is brought up to date with an account of the use of ampere-hour meters and special instrument connections. Recognizing that the tires of an electric vehicle constitute one of the most important factors in both its easy riding and its efficient operation, the compilers have included a thirty-two-page discussion of solid and pneumatic types, with tables of carrying weights, air pressures to be used, methods of vulcanizing, etc. Motor parts, controllers, frames, transmissions, steering gears, etc., occupy the closing pages of the volume except for the appendix, which includes cost and operating data on the use of commercial electric trucks compared with horse traction. Principles of accounting to be applied to electric-vehicle operation are given in the final chapter, which is a valuable one.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Starters for Motorcycles

In the Nov. 15 issue of the *Electrical World* a description was given of the electric starters for motorcycles exhibited by the Hendee Manufacturing Company, Springfield, Mass.,

FIG. 1—MOTORCYCLE EQUIPPED WITH ELECTRIC STARTER

at the second national motorcycle, bicycle and accessory show held at Chicago. A view of the Indian machine is given herewith, showing how the casing containing the batteries is suspended beneath the saddle. The electric-starter motor is attached below the batteries and is completely inclosed. The drive is direct to the gasoline-engine shaft through an inclosed roller chain and a cone clutch.

As a starting device the motor works under a compound field, using both series and shunt winding. As a charging dynamo it operates with the shunt winding only. Thus through the medium of the controller-switch arrangement the combination of a compound motor and shunt dynamo is obtained. A magnetic regulator governs the armature

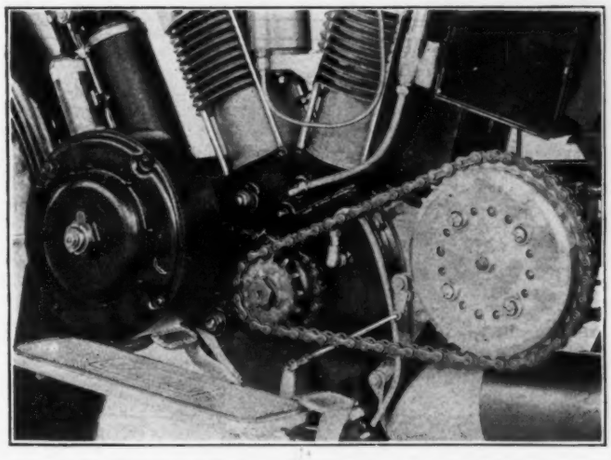


FIG. 2—ELECTRIC STARTER AND ENGINE DRIVE

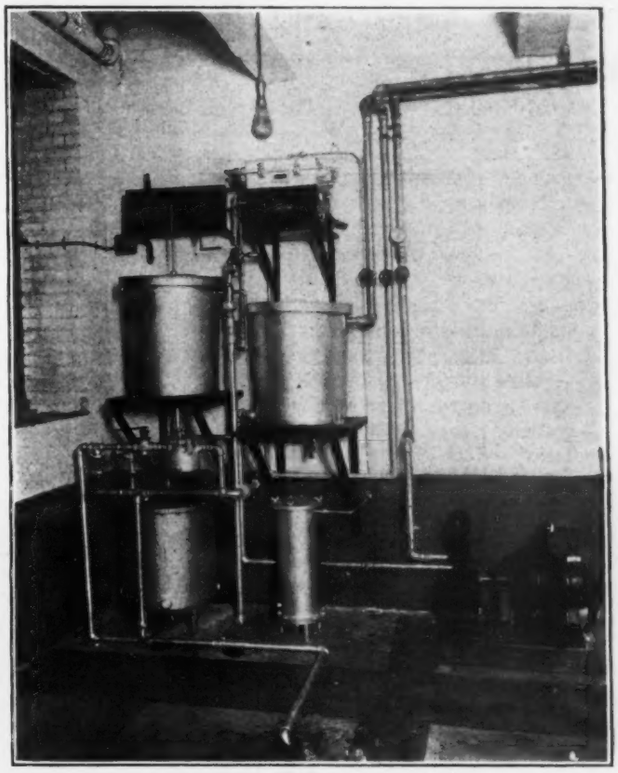
output, giving the correct charging rate, which is usually taken as 9 amp per hour.

The complete electrical system weighs 62.75 lb. The individual weights are: Motor-generator, 25.25 lb.; batteries, 14.5 lb. each; head-lamp, 2.25 lb.; tail-lamp, 0.5 lb.; signaling apparatus, 2 lb.; regulator, 1.5 lb.; switch block, 1 lb.; connecting block, 0.25 lb.; wiring, 1.25 lb.

Ozone Water-Purifying Apparatus

The American Ozone Company, Niagara Falls, N. Y., is manufacturing two types of ozone water purifiers based on the discoveries of the French electro-chemist, M. Marius Otto. One type is designed for intermittent use in residences and offices, and the other for hotels, apartment houses, office buildings, factories, etc.

The small-size "Ozosure" water purifier consists of an ozone generator inclosed in an aluminum box fitted with an air drier for removing the moisture from the air used in the generation of the ozone. A tin pipe connects the ozone generator with the faucet. The ozone is drawn into the purifier faucet by the suction of an emulsifier or mixer, which at the



OZONE WATER-PURIFYING APPARATUS

same time forces the ozone into the water as it passes through the faucet. The box occupies a space measuring about 13 in. by 12 in. and protrudes about 9 in. from the wall.

The purifier faucet operates automatically, the ozone generator being started up and the water turned on with one movement by pressing down the handle. A single upward touch similarly closes the faucet and switches off the supply of energy. The lighting of an indicator lamp on the generator box shows whether the ozonizer is in full operation or not. This small purifier has a capacity of from 1.25 gal. to 1.5 gal. per minute. It is portable and can be taken with tourists when traveling and attached wherever suitable electric service is available.

The larger apparatus, although different in design, is

identical in principle with the type just described. It forms a permanent plant which can be installed in any convenient part of the building where connection with the main water-supply service pipe can be had. Its purifier consists of an ozone generator made of enameled cast aluminum, an air drier, an emulsifier and mixing valve, an automatic float switch, a solenoid and a porcelain-lined, enameled tank of sufficient capacity to insure a constant supply of treated water. The capacity of this purifier ranges from 500 gal. per day up. The apparatus shown in the illustration is installed in a seventeen-story building at Buffalo, N. Y. The equipment is not complicated and does not require very much space. Sufficient water is treated to supply all the offices of the building in addition to a circulating system which has a drinking fountain on each floor.

In places where the water is liable to be turbid a filter is a necessary adjunct of the ozonizing apparatus, as the purpose of the latter is to purify the water and not to clarify it.

High-Tension Pole-Top Switch

In the accompanying illustration is shown a high-tension pole-top switch for outdoor substations. The 10-ft. cross-arms are used to support the channel-iron bases on which the switching elements are mounted, the three single-pole

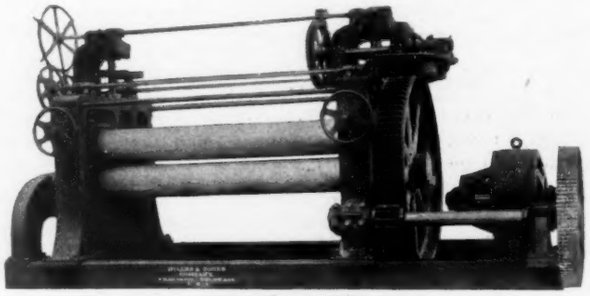
POLE-TOP SWITCH

units being mechanically interlocked so that they operate simultaneously. The operating rod extending down the pole is provided with a handle which can be locked in either open or closed position as desired. Circuits can be opened under full-load conditions with this equipment, the arc being ruptured on magnetic blow-out discharging horns. The contacts and operating mechanism are designed so as not to freeze in cold weather. This switch is manufactured by the Delta-Star Electric Company, Chicago, Ill.

Plate-Straightening Machine

What is declared to be the largest plate-straightening machine ever built is shown in the illustration herewith. The distance between housings or uprights is 10 ft. 5 in. The machine has six forged-steel rolls, each of which is finished to a diameter of 16 in. Three of these rolls are in the upper tier and three in the lower. Two of the upper rolls are placed alternately with the lower rolls to provide corrugating action on the plate passing through the machine. The third upper roll, which has independent adjustment both vertically and laterally, pinches or stretches the plate at any desired point. The straightener is designed to attain its maximum capacity when handling 3.5 per cent nickel-steel plates 1.375 in. thick at a roll speed of 40 ft. per minute.

The machine is operated by a Westinghouse 100-hp variable-speed reversing motor, the machine and motor be-



LARGEST PLATE-STRAIGHTENING MACHINE

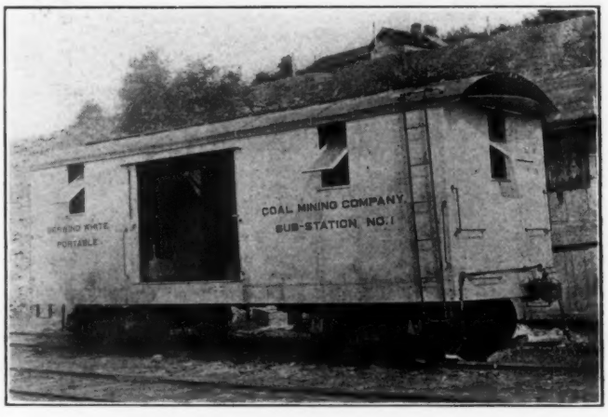
ing supported on the same base. The motor is directly connected to the main driving shaft through cast-steel gears. The pinching roll is counterbalanced at each end to prevent sudden drop after the operation of straightening a plate is completed. The raising and lowering of the other two upper rolls is accomplished by means of a friction clutch. The machine weighs 120,000 lb.

The machine was built by the Hilles & Jones Company, Wilmington, Del., for the St. Lawrence Bridge Company, which will use it in connection with the work on the new Quebec bridge.

Portable Substation for Coal Mine

The Berwind-White Coal Mining Company, Windber, Pa., has recently added a 400-kw Westinghouse portable substation to its equipment and is using this substation in the development of its outlying properties where permanent substations have not yet been erected. The portable substation's equipment, which is similar to that in a permanent installation, comprises transformers, a switchboard and a rotary converter. The apparatus is mounted in a car resembling an ordinary freight car.

When the work at a new development reaches the point



PORTABLE SUBSTATION FOR COAL MINE

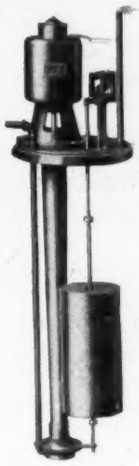
where direct current is necessary, the portable substation is hauled out to the workings, connected to the alternating-current transmission system, and is started to work generating direct current. When the permanent substation is built the portable one becomes unnecessary and is taken to the next development.

The portable substation is also used as an auxiliary in

case of break-down. If accidents occur at any of the permanent substations, the portable outfit is sent to carry the load until repairs can be completed. One portable substation is thus practically the equivalent of a duplicate set of apparatus at each permanent substation.

Automatic Electric Cellar Drainer

The automatic electric cellar drainer illustrated herewith consists of a centrifugal pump directly connected to a vertical motor. The pump is installed in a 3-ft. well into which the seepage drains, while the motor and control apparatus are mounted on the floor level where they are accessible for inspection and out of the way of moisture.



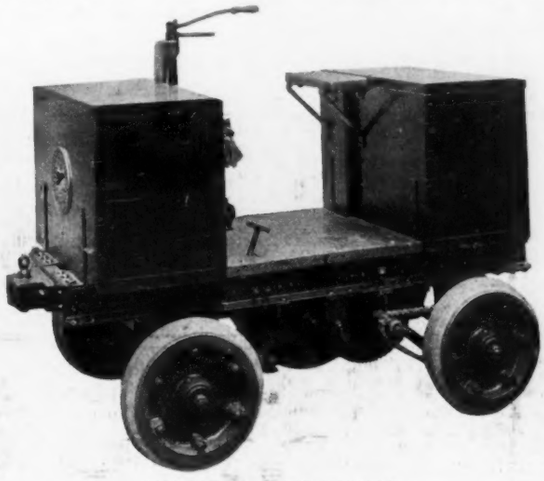
CELLAR-DRAIN PUMP

A float plays between two stops on a vertical rod which is connected to the motor-control switch. When the water in the well rises sufficiently to cause the float to press against the upper stop, the motor is started, and it continues in operation until the water level is so lowered that the float presses against the lower stop, thus cutting off the supply of energy. The pump shown is rated to deliver 500 gal. per hour against a head of 5 ft. and 150 gal. per hour against a head of 20 ft.

This apparatus is manufactured by the Vaile-Kimes Company, Dayton, Ohio, with the exception of the motor, which is the product of the Westinghouse Electric & Manufacturing Company.

Storage-Battery Trucks and Tractors

The Atlas Car & Manufacturing Company, Cleveland, Ohio, is placing on the market rubber-tired storage-battery trucks and tractors for hauling and handling freight in and around manufacturing plants, warehouses, railway and baggage depots, etc. The tractor illustrated herewith can exert

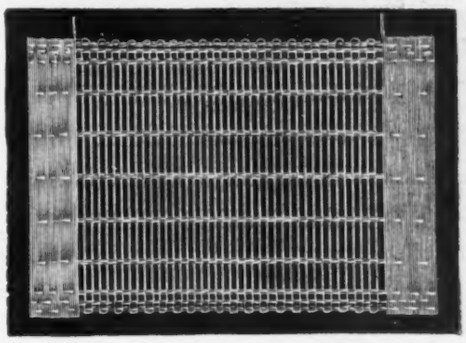


STORAGE-BATTERY TRACTOR

a drawbar pull of 300 lb. and will haul trailer loads up to 10 tons over level floors. The truck has a capacity of 3000 lb. and will carry this load up grades. One charge of the batteries is sufficient to operate either the tractor or the truck throughout a working day of ten hours. The wheels are made of steel and are equipped with roller bearings and solid-rubber tires. The power is transmitted from the motor to the wheels by differential gears, thus permitting the wheels to turn independently in rounding curves.

Heating Apparatus

The Dubilier Electric Company, 63 Fifth Avenue, New York, is placing on the market a heating unit which contains no metal except that of the resistor wiring itself. This heater, as illustrated herewith, is made of high-resistance material which is interwoven with pure asbestos cord. The whole is treated and made rigid so that it can-

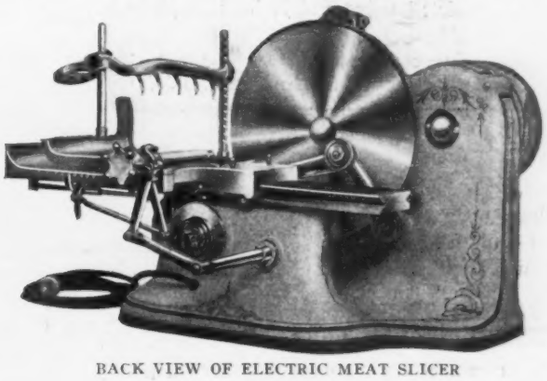


HEATING UNIT

not be easily deformed. Connections can be made every few inches, and when used in motor-starting rheostats the strips can be arranged with such intervals of resistance that the motor will accelerate without jerks. The unit is light and durable and as a resistor is well adapted to use for cranes and railway controllers on account of its ability to withstand the effects of violent vibrations.

Electric Meat Slicer

The motor-driven meat slicer illustrated herewith is the product of the A. J. Deer Company, Hornell, N. Y. It is provided with ball bearings throughout and the carriage of the device is controlled by an automatic release clutch. An electric sharpener keeps the cutting edge of the knife always keen. The adjustment giving thick or thin slices of meat can be changed when the machine is in operation. The slicer is designed so that the carriage works inde-



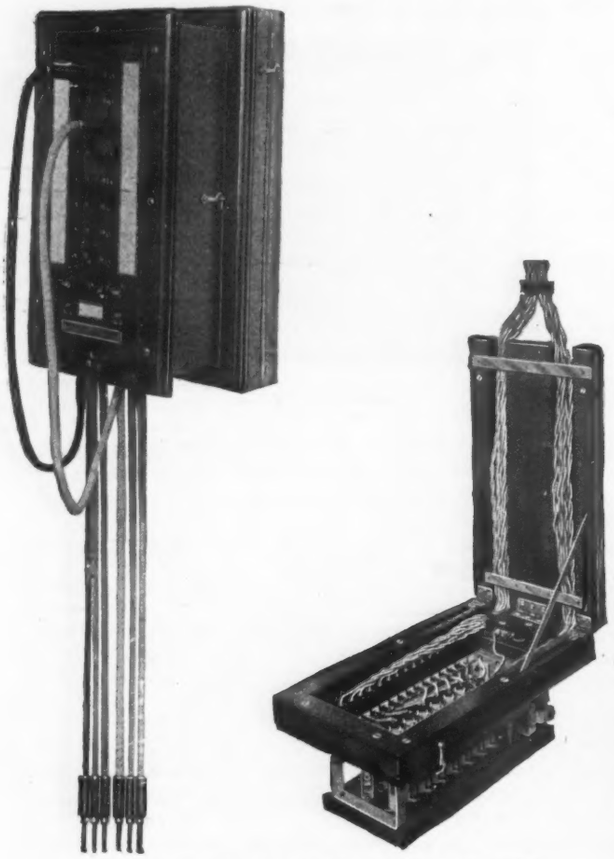
BACK VIEW OF ELECTRIC MEAT SLICER

pendently of the knife. The machine is 30 in. long, 28 in. wide, 21 in. high and weighs 248 lb.

Railway Way-Station Test Boards

The Western Electric Company, New York, has developed and placed on the market a test board for testing and "patching" telephone train-dispatching circuits so that interruptions to service may be minimized. Two kinds of boards are used, one being equipped for two metallic circuits and the other for four metallic circuits. The board, together with the accompanying cabinet, is made of oak. The jacks through which the lines are carried are mounted

on the face of the board, each with its designation strip. Below these jacks are mounted keys for switching the selector and telephone equipment from its regular circuit to the patching cords. The patching cords, which are moisture-proof, hang from the bottom of the cabinet and are connected to terminals inside the test board. The wiring



FIGS. 1 AND 2—TEST BOARD, CLOSED AND OPEN

is run in twisted pairs and is held in place by removable straps.

A removable cover, which is fastened in place by hooks, gives ready access to all line terminals, while the jack terminals are easily found when the apparatus board hinged at the lower edge is opened. All wires, as can be seen from Fig. 2, are visible for inspection when the apparatus board is opened.

The train wire and the message wire are carried through the test board, provided two such circuits are used. If no message wire is installed two telegraph circuits are usually made up of iron wire and brought through the test board for possible use in patching. The telegraph wires are also frequently brought into the test board even if a message wire is used. The train wire, being most important, must always be kept working, thus making it necessary to carry the message and telegraph wires through the boards in order that they may be used for patching in emergencies.

Cable-Reel Jack

The cable-reel jack illustrated herewith has a reversible frame top or head by means of which the screw can be placed in three different positions to accommodate different sizes of reels, thus making one jack take the place of three. In Fig. 1 the frame top is shown resting on the lower cross-pieces and so placed that the screw barrel attached to the frame top is above the head plate. This is for the lowest position with a minimum height of 18 in. In Fig. 2 the frame top is turned around so that the screw barrel is below the head plate and is placed on the top part of the frame. This is the intermediate position, giving a minimum height of 24 in. By turning the top so that the barrel is again above, the highest position with a minimum height of 32 in. is attained. This is shown in Fig. 3. The

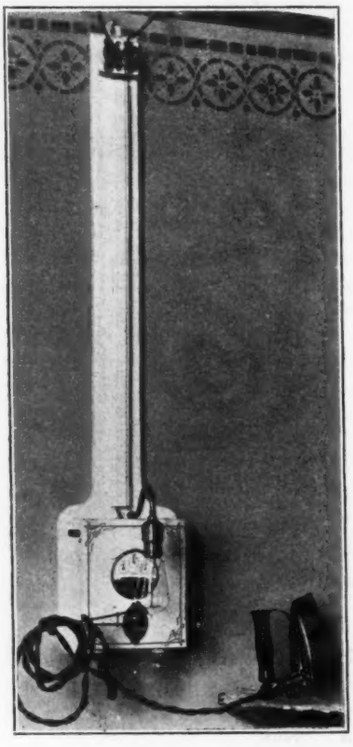
FIGS. 1, 2 AND 3—CABLE-REEL JACK WITH REVERSIBLE FRAME

jack is made to accommodate reels varying from 36 in. to 80 in. in diameter. The frame legs rest on floor plates.

The device was designed and patented by Mr. Colman J. Mullin and is manufactured by the Norris Electric Specialties Company, 38 Park Row, New York.

Electric Wall Cabinet

The electric wall cabinet shown in the accompanying illustration is a portable device for introducing electric service quickly and at low cost into unwired houses where the owner does not care to install the usual wiring. The meter is incased in an iron box which is fastened to a wooden base, the whole being hung from a nail in the wall in any part of the building where the line wires may be reached easily. A swinging arm is attached to the box for supporting the flexible cord feeding the iron, and a pilot lamp indicates when the iron is in circuit. This lamp is shown beneath the box, but in later types it is placed inside. A bracket and an incandescent lamp for lighting purposes are also provided.



ELECTRIC WALL CABINET FOR UNWIRED HOUSES

In order to cut down the cost of the installation, the meters can be mounted inside the box at the meter shop, the entire apparatus being thus readily portable. One man can install the outfit. He first drives a nail or screw into the wall 9 ft. or 10 ft. above the floor, hangs the board as shown, plumbs it, puts in the bottom screw, bores two holes just above the fuse blocks the regulation distance apart, puts in two porcelain tubes, and then shoves through the two wires already provided, making connection with the line drop outside.

The cabinet was devised by Mr. W. E. Clement, contracting agent of the New Orleans Railway & Light Company, and is being manufactured by the Electrical Development Company, New Orleans, La.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Large Cable Order Placed with the Western Electric Company.—A recent order placed with the Western Electric Company by the Cumberland Telephone & Telegraph Company called for 79,000 ft. of 600 pair conductor, or about 18,000 miles of single conductor. This order is considered of unusually large size.

Large Stationary Diesel Engine Sold.—Through their United States representative, W. R. Haynie, 30 Church Street, New York, Carels Frères, of Ghent, Belgium, have just closed a contract with the Coronet Phosphate Company, 99 John Street, New York, for a 750-hp Carels two-stroke-cycle stationary Diesel engine, for direct connection to a 500-kw alternator, to be installed in its power plant at Pembroke, Fla.

Storage Battery Sales Conference.—During the week of Dec. 1 the Electric Storage Battery Company, of Philadelphia, Pa., held a sales conference at the Bellevue-Stratford Hotel in that city, attended by the managers of its several sales offices. In celebration of its twenty-fifth anniversary, the company held on the same date a reception for the representatives of various electric-vehicle manufacturers. Following an informal luncheon at the factory, an inspection was made of the company's shops. In the evening a banquet was given to the guests of the company at the Ritz-Carlton Hotel.

Terry Turbines Make Unusual Record.—In the plant of the Toledo (Ohio) Railway & Light Company two 40-hp Terry turbines have been operating almost continuously since 1909 at 1800 r.p.m., driving Sirocco blowers for forced draft. During the four-year period it is reported that not a cent has been spent for repairs on either turbine. Placed on a steel framework about 50 ft. above the floor line of the engine room, they are visited only once a month to make sure that oiling and adjustments are correct. While one or the other, and frequently both, of these turbines have been continually in operation throughout this period, they are reported never to have given the slightest trouble.

New Colliery Breaker to Be Electrically Operated Throughout.—The new Loomis colliery of the Delaware, Lackawanna & Western Railroad Company is rapidly nearing completion, and the breaker, on which work is now progressing, is to be electrically operated throughout. Energy will be supplied for this purpose by the Nanticoke (Pa.) power plant of the company, which is at present furnishing electricity for the operation of the Truesdale colliery breaker. Similar to the latter breaker, the one at the Loomis colliery will be equipped in general with individual motor drive for the various machines, such as shakers, grids, spiral separators, sorting tables, rolls and jigs, used there for breaking and grading the coal.

Storage Batteries Used to Operate Raft Lamps.—A great deal of the timber cut in the territory drained by the Columbia River and its tributaries is floated down that stream annually in immense rafts. To prevent interference with navigation in the daytime these rafts have to be towed down the river at night, and to guard against accidents it is necessary to place lights at each end of every raft. For some time past electric lights have proved very popular for this service, and a raft-light outfit assembled by the Astoria Hardware Company, of Astoria, Ore., has enjoyed a good sale. Two 4-cp lamps wired in parallel furnish the light and are run from a battery of two 6-volt storage cells, with a capacity of 100 amp-hr. These batteries are supplied by the Electric Storage Battery Company, of Philadelphia, Pa.

Decline in Orders Noticed by the Western Electric Company.—For the ten months ended Oct. 31 the sales of the Western Electric Company were at the rate of $76,000,000 per annum. During the month of October the volume of business billed out by that company was large but the volume of new orders received was not equally satisfactory. Early in 1913 there was an unusually large business handled, but in the succeeding months the figures on new business have been approaching more nearly to normal until at the present time they appear destined to go somewhat below that level. It is stated by the company that the number of orders is larger than usual now, but that their average size is smaller than is ordinarily the case, so that, while the total volume of business is less, the cost of handling it is as great as or greater than usual.

Electrical Equipment Planned for the Bureau of Mines Testing Plant at Pittsburgh, Pa.—The estimate of appropriations for the United States Bureau of Mines for the fiscal year ending June 30, 1915, as approved by Secretary Lane of the Interior Department, has just been forwarded to Congress. The several items in this estimate total $752,000, representing an increase of $90,000 over the figures for the fiscal year ending June 30, 1914. Among the items on the first-mentioned estimate is one of $10,000 for the purchase of equipment for the testing plant at Pittsburgh, Pa. This is a new item, and it is stated that the money is needed for the purchase of both steam and electrical equipment. In support of this claim, the estimate states that the present power and electric service plant at the experiment station is entirely inadequate to the demands placed upon it and is in constant danger of break-down.

Electric Pleasure-Car Company to Enter Truck Field.—Announcement has just been made that the Chicago Electric Motor Car Company will soon begin the manufacture of commercial electric vehicles. It was stated that the increased facilities for production, which have recently allowed this company to make marked reductions in the prices of pleasure cars, will also permit its entry into the electric-truck industry. No changes are to be made in the Chicago organization, but with the expansion of the company Mr. C. A. Neuracher and Mr. A. L. Garford, well-known men in the automobile industry, have become allied with the company, Mr. Neuracher now being president and chief engineer. Mr. Gail Reed, of Chicago, has been made secretary of the expanded organization. Definite announcement as to whether the commercial vehicles will be made in Chicago or in Toledo factories of the company, has not been made, but rumor has it that most of this work will be carried on in the Ohio city.

Efforts to Boom Trade with Russia.—In an effort to open up to American products the vast Russian Empire, which has a population of about 150,000,000, a market which has hardly been touched by American manufactures, the National Association of Manufacturers has planned a new department of its organization, which will be known as the Russian and Far Eastern division and will have for its object the fostering of trade relations between the two countries. A. J. Wolfe, formerly connected with the Department of Commerce, is to have charge of this new division. It was stated by a representative of the association that official recognition has been taken in Russia of the efforts to provide, in this new division, the necessary auxiliary services for promoting an increased trade between that country and the United States, and at the conference to be held in the offices of the association, at 30 Church Street, New York, on Dec. 16, on the occasion of the inauguration of the new service, the principal address will be delivered by C. J. Medzikhovsky, commercial attaché to the Russian Embassy at Washington. Other speakers conversant with Russian trade conditions will also address this meeting.

Specially Designed Electric Truck for Hauling Ice.—The Baker Motor Vehicle Company, of Cleveland, Ohio, has recently sold to the Porto Rico Ice Company a 3½-ton electric truck some of the features of which are unusual. On account of the torrid heat in Porto Rico and the long haul of 6 miles over which ice must be carried from the central plant of the company to a substation, it was necessary to have a truck body as near heat-proof as possible. To meet these conditions the following special construction was followed: The sides, front and roof of the body are of double-panel construction, 4 in. thick, and all packed between the panels with cork. To withstand the intense heat from the ground, the floor is made 4½ in. thick and is built in layers. From top to bottom these layers are 1 in. solid oak plank, 1¾ in. asphalt composition, 1 in. cork board and ¾ in. Georgia pine board. The rear doors of this truck are regular refrigerator doors, and when they are closed the truck is a veritable refrigerator, practically air-tight, and will carry ice in hot Porto Rico many miles. Inside the body are adjustable cross-bars which can be put in against the ice to hold it from shifting while in transit, whether the truck is loaded full or not. The storage batteries used in this car are of the "Ironclad Exide" type, manufactured by the Electric Storage Battery Company, of Philadelphia, Pa.

Foreign Markets for Electrical Wiring Devices and Supplies.—In Austria electrical specialties are in general use. Sockets, switches, conduits, plugs and small apparatus such as hair driers, fans, heaters and electric irons can be bought at ordinary prices within 5 or 10 per cent of the retail prices in the United States. These are mostly made in Austria or Germany, and are as convenient as the American product, although perhaps not as durable. The American Edison standard socket is not known there, the Bergmann Isolier socket being largely used. In Belgium there is a spirited German competition in electric-light supplies, and the merchants of that country sell these supplies at prices almost defying competition. At the same time the field for electrical development in Antwerp is unlimited. There are no jobbers or wholesalers in this district, and goods cannot be sold by correspondence. All trade literature must be in French, and prices and measurements must be in francs and the metric system respectively. Dealers in Salonica, Greece, import directly from the manufacturers in Austria-Hungary or Germany, but many of them would be glad to import from America if prices and terms that compare favorably with those they now obtain can be offered. These dealers state that there is no special apparatus suited to the needs of their market, but they express a desire to handle a line of electrical novelties, such as curling irons, coffee pots, toasters, hot plates and electric irons, all of which are unknown there. The energy supplied in that locality for lighting is 220 volts direct current. There is a great deal of competition in the incandescent electric-light business in Milan, Italy, although American electric-light apparatus is not found in this market to any appreciable extent. There are no manufacturers of electrical materials in Palermo, Italy, practically the entire demand being supplied by German concerns or by manufacturers in northern Italy. There are a few electrically heated devices to be found in Norway, the majority of which are made in Germany or England. For the most part these are cheaply made, and if American manufacturers are to obtain a good share of the business it will be necessary for them to offer low-priced utensils of good quality. Electrical supplies are extensively manufactured in Sweden, but the import from foreign countries is also considerable, especially from Germany. Sockets are always of the American Edison base standard. There are no imports from the United States.

Large Electric Mine Hoist Contract Awarded.—To the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., was awarded in November the contract for building the largest electric hoist in the Western Hemisphere and one of the largest of its kind in the world. The purchaser is the North Butte Mining Company, and the hoist will be put in service at the Granite Mountain copper mine of that company. The technical details of this equipment, as it is planned, are of considerable interest. The hoisting drums, which will be 12 ft. in diameter, will be driven by a directly connected electric motor, running at a speed of about 71 r.p.m. Power will be supplied to this motor from a motor generator set equipped with a 50-ton flywheel to secure elimination of the peaks that would be drawn from the power line during periods of starting and acceleration. Hoisting with this equipment will be done in balance, but the equipment is large enough to take care of unbalanced hoisting. The capacity of the hoist will permit 300 tons per hour being hoisted from the 2000-ft. level, or 200 tons per hour from the 4000-ft. level. The system of control and power equalization used will be that commonly known as the Ilgner system, in which a flywheel driven by the motor-generator set is permitted to give up some of its stored energy to supply the peak load drawn by the hoisting motor. In order to reduce the flywheel losses to a minimum, the flywheel will be incased in a smoothly finished steel housing and provided with special type of self-lubricating bearings. The hoisting motor will be of the type used in steel mills and will be of a very heavy construction. In fact, all of the equipment has been designed with absolute reliability as the paramount consideration. This motor will have a maximum intermittent rating of 4500 hp, and the motor-generator set will be driven by an induction motor having a continuous normal rating of 1400 hp. The difference between these ratings represents approximately the amount of energy that will be supplied by the flywheel momentarily during starting. The installation is so designed that the draft of power from the power line will be practically constant throughout any cycle of hoisting. A number of special safety devices are comprised in the equipment, including electrically released brakes, automatic slow-down devices to prevent skip or cage ever going through head-sheaves, and a special controller to limit the speed when hoisting men.

Statement of the Copper Producers' Association for November

A further increase in the stocks of copper on hand is shown by the figures in the following monthly statement for November. This seems to be the result not so much of an increase in production as of a big falling off in domestic consumption.

	November, pounds		October, pounds	
Stocks on hand in the United States on first of month		32,566,382		29,793,094
Production		134,087,708		139,070,481
		166,654,090		168,863,575
Domestic deliveries	48,656,858		68,173,720	
Foreign deliveries	70,067,803		68,123,473	
		118,724,661		136,297,193
Stocks on hand at end of month		47,929,429		32,566,382

NEW YORK METAL MARKET PRICES

	Dec. 2 Bid.	Dec. 2 Asked.	Dec. 8 Bid.	Dec. 8 Asked.
Copper:				
Standard, spot*	.....	.....	.....	.....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	65 15 0		65 10 0	
Prime Lake	15.00	.....	14.50	to 14 75
Electrolytic	14.50	to 14.75	14.25	to 14.50
Casting	14.37½	.....	14.12½	to 14.25
Copper wire base	16.00	.....	15.50	to 15.75
Lead	4.10		4.10	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.50		7.25	
Spelter, spot	5.15	to 5.20	5.12½	to 5.25
Tin, spot	38.50	to 39.00	37.50	to 37.75
Aluminum:				
Prompt delivery	19.00	.....	19.00	.....
Future	18.75	to 19.25	18.50	to 19.00

*OLD METALS

Heavy copper and wire	13.50	13.50
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	4.20	4.05
Zinc, scrap	4.37½	4.37½

*COPPER EXPORTS

Total tons to Dec. 8 6,682

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Canadian General Electric Declares Extra Dividend.—An extra dividend of 1 per cent on the common stock, in addition to the regular quarterly dividend of 1¾ per cent, has been declared by the Canadian General Electric Company and will be payable Jan. 2. An extra dividend of like amount was declared on this stock a year ago.

Central Illinois Public Service Company Increases Its Capital Stock.—The Central Illinois Public Service Company, of Mattoon, Ill., which is one of the subsidiary companies of the Middle West Utilities Company of Chicago, has certified to the Secretary of the State of Illinois that it has increased its capital stock from $6,000,000 to $10,000,000.

Annual Report of the Northern California Power Company, Consolidated.—In its annual report for the year ended Oct. 31 the Northern California Power Company, Consolidated, showed gross earnings of $814,238 and a net operating surplus of $213,237. During the year ended on the above date the company added 1069 customers to its business, with a load of 3475 hp. During the coming year the company expects to add 5325 hp more to its connected load, part of which is already under contract. The copper companies in its territory are large users of electricity for electrolytic refining of ores.

Boston Edison Stock Issue Voted.—At an adjourned meeting held on Dec. 3 stockholders of the Edison Electric Illuminating Company of Boston, Mass., voted to increase the capital stock from $18,204,400 to $20,480,000 by the issue of 22,756 new shares. The present capital stock consists of 182,044 shares. There were over 100,000 shares represented at the meeting. The directors have set the price of the new issue at $215 per share, offering the rights for subscription by the stockholders on a one-eighth basis. The company will neither buy nor sell rights. Rights to subscribe for the new issue will expire on Dec. 30.

Assessments on Stock of the Columbus Railway & Light Company.—Two assessments of $10 each have been called on the $5,000,000 capital stock of the Columbus Railway & Light Company by its board of directors. The first payment is to be made on or before Dec. 30, 1913, and the second on or before June 30, 1914, and these assessments will make the stock $40 a share paid up. After payments have been made, the stock will be exchanged for stock of the Columbus Railway, Light & Power Company, under which the properties now operated by the Columbus Railway & Light Company will be consolidated.

Proposed Stock Increase of Tampa Electric Company.—A special meeting of the stockholders of the Tampa (Fla.) Electric Company has been called for Jan. 5 to vote on the proposition for an increase of $374,000 in the capital stock of the company. It is proposed to offer the new stock to the stockholders for subscription at par, on a basis of one share of new stock for each six shares of old stock held. The reason given for this issue is that funds are needed for the payment of a floating debt of $125,000, incurred by the company during the past year for extensions and improvements, and that money will be needed to finance further improvements planned for the coming year.

Canadian Utility Purchased.—The Sherbrooke Railway & Power Company, of Sherbrooke, Que., has recently purchased the Burrows Falls Power Company, which supplies the electric lighting and power service in Ayers Cliff, Que. The first-named concern now owns numerous electric generating properties in this neighborhood, all of which are connected by the main transmission line from the company's central station at Sherbrooke. This company has been pushing its power sales recently and has secured contracts for industrial power, three of which are for 700 hp, 500 hp and 150 hp respectively, with enough small contracts to make a total of about 1500 hp of new business, most of which will become connected load within the next quarter.

Puget Sound Traction to Make Note Issue.—A meeting of the stockholders of the Puget Sound Traction, Light & Power Company has been called for Dec. 23 to authorize the issue by the company of short-term bonds, the proceeds of which are to be used for refunding notes for $7,500,000, which mature on Feb. 1, 1914. Note was made in the *Electrical World* of Nov. 1 of a recent increase in the capital stock of the company which was made for the purpose of meeting this obligation. The new bond issue is planned in order to supplement the first move toward retiring the above-mentioned notes. No statement has been made as to the amount, interest rate or length of maturity of the proposed issue, but nothing longer than five years is expected. The notes, if authorized, will be secured by a mortgage on the property of the company.

Stockton Gas & Electric Corporation's Bonds to Be Redeemed.—The outstanding first mortgage twenty-five-year 6 per cent gold bonds of the Stockton Gas & Electric Corporation, dated Jan. 1, 1909, have been called for payment and redemption on Jan. 1, 1914, under the terms of the issue. These bonds will be redeemed on the above date at the office of the Mercantile Trust Company, 464 California Street, San Francisco, Cal., at their face value and interest at 6 per cent, together with all accrued interest at the same rate which shall not have been paid at that time. Interest will not be paid on the bonds after Jan. 1, 1914. This company was consolidated several years back with six other electrical properties in California and is at present controlled by the Western States Gas & Electric Company, one of the holding companies in which H. M. Byllesby & Company have a controlling interest.

Capital Stock of National Gas, Electric Light & Power Company Increased.—A certificate was filed at Trenton, N. J., recently, increasing the capital stock of the National Gas, Electric Light & Power Company from $4,000,000 to $10,000,000. The stock now consists of $5,000,000 common and an equal amount of 6 per cent preferred shares. The company controls the following public utility properties: The Cape May (N. J.) Illuminating Company, the Carbondale (Pa.) Gas Company, the Goshen (Ind.) Gas Company, the Joplin (Mo.) Gas Company, the Niles (Mich.) Gas Company, the Port Huron (Mich.) Light & Power Company, the Port Huron Gas Company, the Portsmouth (Ohio) Gas Company, the Quincy (Ill.) Gas, Electric & Heating Company, the Rome (N. Y.) Gas, Electric Light & Power Company, and the Warsaw (Ind.) Gas Company. Its president is J. T. Lynn, of Detroit, Mich.

Present Status of the Utah Securities Corporation.—Under date of Dec. 1, a statement was issued by S. Z. Mitchell, president of the Utah Securities Corporation, covering the status of that concern, as follows: "The Utah Power & Light Company and its subsidiary, the Western Colorado Power Company, now have in operation twenty-three hydroelectric generating stations, of an aggregate rated capacity of 76,900 hp, with three steam-reserve generating stations, of an aggregate rated capacity of 13,200 hp. There is under construction a 29,250-hp addition to the hydroelectric plant at Grace, Idaho, which is to be completed early in 1914 and which will increase the capacity of this plant from 14,750 hp to about 44,000 hp. When this addition is placed in operation the aggregate rated capacity of the hydroelectric plants of the subsidiary companies will be increased to 106,150 hp. There is also being constructed a new development at Oneida, Idaho, which will have an initial capacity of 27,000 hp. Your subsidiary companies now have in operation a total of 1660 miles of high-tension transmission and distributing lines. There are under construction and approaching completion 133 miles of 130,000-volt and 14 miles of 44,000-volt double-circuit steel-tower transmission line and 42 miles of 44,000-volt pole line, making a total of 189 miles of high-tension transmission lines now under construction. The number of customers of the operating companies has been increased from 11,622 as of June 1, 1913, to 13,315 as of Oct. 31, 1913, while the capacity of motors, lights and other electrical machinery of the customers as of Oct. 31, 1913, aggregated 70,204 hp, as compared with 66,212 hp as of June 1, 1913. It is expected that when the addition to the Grace plant is placed in operation, early in 1914, both the gross and net earnings will be materially increased, as it will be possible to supply additional power under contract but which cannot now be delivered because of insufficient plant capacity." The gross earnings of these companies for the twelve months ended Oct. 31 amounted to $1,664,216, and net earnings of $977,015 were realized. The total output of the generating stations operated by them during the month of October was 21,936,101 kw-hr.

Business Notes

Harvey Deschere & Company is the new name of the interchangeable sign business carried on at 50 Church Street, New York, by Harvey Deschere.

The Electric Construction & Machinery Company, 1622 Second Avenue, Rock Island, Ill., has just made the announcement that after Jan. 1, 1914, its office address will be 1828 Third Avenue, Rock Island.

The Waco Electrical Supply Company announces that R. S. Wakefield, until recently manager of the Fort Worth (Tex.) branch of the Wesco Supply Company, has resigned from that company to become connected with the Waco Electrical Supply Company, of Waco, Tex.

The Clark Electric & Manufacturing Company, Singer Building, New York, specializing in transmission-line supplies and protective devices, has recently enlarged its line and is now supplying finely finished ornaments of cast brass or bronze for use in lamp fixtures and pedestals.

The Watauga Power Company has recently announced the removal of its general offices to 615 State Street, Bristol, Tenn. All matters relating to the company will be handled from this office in the future. The general manager of the company is S. M. Vance, and M. P. Steelman is its secretary and treasurer.

The Ideal Electric & Manufacturing Company, of Mansfield, Ohio, has lately reopened its Chicago office, which is now in the Fisher Building, 343 South Dearborn Street. Its district manager in charge, J. A. Adamson, has been engaged in the sale of electrical machinery in this territory for a number of years.

The Century Electric Car Company, of Detroit, Mich., has established a New England agency, with headquarters at 410 Newbury Street, Boston, in charge of Edward Atkins. The company manufactures two sizes of electric broughams, a four-passenger car having the only underslung chassis on the market and a five-passenger car with duplex control. It is the company's intention to establish other agencies in the principal cities of New England.

New Industrial Companies

The F. E. Davis Engineering Company, of Detroit, Mich., has been organized by F. E. Davis, of Detroit, to manufacture the Kemco, an attachment for charging the lighting batteries of an automobile.

The Shawmut Electric Signal Company, of Boston, Mass., has been incorporated with a capital stock of $300,000 by James B. Clogher, Edward L. Parsons and James M. West. The company proposes to manufacture electric and magnetic signals.

The H. L. F. Trebert Rotary Motor Company, of Rochester, N. Y., has been chartered with a capital stock of $150,000 to manufacture and deal in machinery. The incorporators are H. L. F. Trebert, M. J. Schrag, of Rochester, and L. G. Ogden, of Penn Yan, N. Y.

The Electric Contracting Company, of Trenton, N. J., has been incorporated with a capital stock of $50,000 to manufacture electrical appliances, machinery, etc. The incorporators are W. Eldridge, of Lawrenceville, N. J.; S. E. Aller, and F. J. Carr, of Trenton.

The Nachod Signal Company, of New York, N. Y., has been chartered with a capital stock of $100,000 to manufacture railway appliances, etc. The incorporators are G. B. Delafield, of New Brighton; J. W. Stone, of Pelham, and W. H. Adams, of New York, N. Y.

The United Gas & Electric Engineering Corporation, of New York, N. Y., has been incorporated with a capital stock of $100,000 to do a general consulting engineering and contracting business. The incorporators are H. Morgan, G. H. Onley and W. M. Clark, of New York, N. Y.

The Swedish Rhythmic Vibrator Company, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture and deal in electric vibrators and other electrical and mechanical appliances. The incorporators are Blake O. Smith, C. E. Barry and William A. McGuire.

Trade Publications

Railway Motors.—Bulletin A4173 of the General Electric Company describes its ventilated commutating-pole railway motor and supersedes the company's previous bulletin on this same subject.

Wiring Devices.—Bulletin No. 829 of Pass & Seymour, Inc., Solvay, N. Y., contains forty pages illustrating and briefly describing a comprehensive line of wiring devices and giving the price of each.

Ornamental Lighting Posts.—A small four-page "throwaway," with insert folder, has recently been printed by the George Cutter Company, of South Bend, Ind., to describe its new five-lamp boulevard post.

Water Sterilizers.—Catalog 12-E, issued by the Forbes Company, 1234 Callowhill Street, Philadelphia, relates to the household type of Forbes water sterilizer. This apparatus sterilizes the water by heat developed electrically.

Small Electric Tractors.—Bulletin 1160, issued by the Atlas Car & Manufacturing Company, of Cleveland, Ohio, describes its line of small storage-battery tractors and freight trucks, which are adapted for use in manufacturing plants and repair shops.

Motor-Driven Exhaust-Fan Outfits.—Motor-driven exhaust-fan outfits for direct current and alternating current form the subject of Bulletin No. A4174, published by the General Electric Company. The bulletin is devoted to the subject of fans for ventilating purposes and contains, in addition to other data, illustrations and dimension diagrams of the various motors built by the company for this purpose.

Electric Breakfast Set.—Folder No. 4266 issued by the Westinghouse Electric & Manufacturing Company, entitled "The Electric Breakfast Set," describes and illustrates the toaster-stove and coffee-pot type percolator and shows how easily a breakfast can be prepared with these convenient devices. The total time required for the preparation of the breakfast is fifteen minutes, and its cost of operation is 2 cents, based on 10 cents per kw-hr. for energy.

Circuit-Breakers.—"Who's Who and What's What" is the title of a thirty-two-page folder, size 4¼ in. by 10 in., which the Cutter Company, Philadelphia, has recently issued. The introduction, by the company's president, Mr. A. Edward Newton, is a brief survey of the company's work in the development of the I-T-E circuit-breaker during the last twenty-five years. Biographical sketches, with portraits, of various employees of the company form the "Who's Who" part of this pamphlet.

The Wallace & Tiernan Company, of 136 Liberty Street, New York, is engaged in the manufacture of special apparatus of various kinds for scientific research work along electrical lines, and it expects by the first of the year to be turning out its complete line of such apparatus, including conductivity cells, Wheatstone bridges, ozone apparatus, air-flow meters and other like products. The president of the company is M. F. Tiernan and C. F. Wallace and C. A. Simpson are vice-president and secretary respectively.

Sliding-Contact Rheostats.—Catalog 780, recently issued by James G. Biddle, 1211 Arch Street, Philadelphia, describes more than 400 sliding-contact laboratory rheostats, with different styles of mounting. The current ratings range from 0.3 amp to 40 amp., and the range of total resistance varies from 0.15 ohm to 5000 ohms. Use is made of special alloy wire wound on thin enameled metal tubes or slate blocks unless a new non-inductive crossed winding is specified. It is said that these rheostats have an almost infinite variety of applications.

Storage Batteries.—The Electric Storage Battery Company, of Philadelphia, Pa., has recently issued a four-page folder containing the paper presented by Bruce Ford at the fourth annual convention of the Electrical Vehicle Association of America, in Chicago. The title of the paper, "Lead Battery Developments During 1913 for Electric Vehicles," explains its scope. The company's latest publication gives extensive information on its type X "Exide" battery for automobile starting and lighting service, together with prices on these batteries and their several parts.

Personal Mention

Mr. E. H. Jaekel has been appointed superintendent of the municipal electric lighting plant at Barron, Wis.

Mr. P. Whitfield has been appointed electrical superintendent for the town of Battleford, Saskatchewan, Canada.

Mr. T. M. Early, of Marietta, Ga., has been made superintendent of the new municipal light and water plant of Gainesville, Fla.

Mr. Alfred Wallace has been promoted from the position of superintendent of the Columbia (S. C.) Gas & Electric Company to the place of general manager.

Mr. Henry J. Appert, Jr., has been appointed assistant manager of the Claremont Power Company and the Colonial Power & Light Company, Claremont, N. H.

Mr. H. P. Davis, of the Ontario Power Company, Niagara Falls, Ont., has resigned to accept the position of superintendent of the Salmon River Power Company at Altmar, N. Y.

Mr. George Baxter, formerly with the Haverhill (Mass.) Electric Company, has been made superintendent of the Exeter (N. H.) plant of the Rockingham County Light & Power Company.

Mr. Clarence P. Westlake has been appointed superintendent of the Columbia (S. C.) Gas & Electric Company as successor to Mr. Alfred Wallace, who has been made general manager of the company.

Mr. Alten S. Miller, formerly president and general manager of the Union Electric Light & Power Company, St. Louis, Mo., has been in Europe, where he has spent several months examining the gas fields of Hungary.

Mr. C. S. Johann has tendered his resignation as manager of operations of all of the plants of the Eastern Pennsylvania Power Company, of Easton, Pa., to join the staff of the Macan, Jr., Company, consulting engineer, in the same city.

Mr. H. Godet, of New York City, has been elected president of the Rico (Col.) Mining Company in place of Mr. Carl Owen, who has resigned. The company operates a hydroelectric plant at Rico, Col., of which Mr. G. E. Hicks is superintendent.

Mr. Hugo Reisinger, New York, the well-known importer of electrodes, who is widely known outside of electrical circles as a patron of art, has been elected president of the Germanic Museum of Harvard University, succeeding his father-in-law, the late Adolphus Busch.

Mr. R. W. Bruce, of London, Eng., has been appointed general superintendent and chief engineer of the Canada Electric Company, Amherst, N. S., and also will have charge of the electrical equipment of the Maritime Coal, Railway & Power Company, at Joggins Mines.

Mr. F. K. Martin, for the past five years electrical superintendent for the town of Battleford, Saskatchewan, Canada, has accepted the position of electrical superintendent for the town of Humboldt, Saskatchewan. Mr. Martin was previously electrical superintendent for the Canadian Ship Building Company.

Mr. Frank F. Fowle, consulting electrical engineer, New York, has been retained as expert for the State in the investigation of telephone rates now under way before the Public Service Commission of Vermont. The investigation will cover all of the companies doing a telephone business within the State.

Mr. R. P. Leavitt, formerly electrical superintendent of the Albany Southern Railroad, of Hudson, N. Y., who resigned from that company on Nov. 15, has assumed his new duties with the New York & Queens Electric Light & Power Company, of Long Island City, N. Y., as superintendent of the Newton district.

Mr. J. H. McClure, formerly of Philadelphia, has been appointed general superintendent of the Citizens' Light & Power Company, Oil City, Pa., as successor to Mr. W. W. Cole, who has been acting general manager of the local railway and lighting company. Mr. Cole, who is a member of the firm of Day & Zimmerman, of Philadelphia, has just completed the work of reorganizing the properties and will return to his many and varied duties in New York, Philadelphia and elsewhere.

Mr. William R. Aldrich has been appointed acting professor of electrical and mechanical engineering at the University of Arizona during the sabbatical leave of absence of Prof. W. W. Henley. During the past two years Mr. Aldrich was connected with the staff of the United States Reclamation Service, Shoshone Project, Powell, Wyo.

Mr. Guy G. Crane has resigned as superintendent of the city water department of Rockford, Ill., to become superintendent of the municipal electric-light and water plant of Lansing, Mich. Mr. Crane was formerly connected with the Allis-Chalmers Company at Milwaukee and took a position with the Rockford & Interurban Company in charge of the electrical and engineering work on Dec. 1, 1906. He remained with that company until April, 1913, when he was appointed superintendent of the water department.

Mr. James G. White, president of J. G. White & Company, Inc., returned Wednesday, Dec. 10, from a six months' absence in England and the Continent. A large part of his time was spent in London at the home office of J. G. White & Company, Ltd., in connection with the recent activities of that concern in the formation of the International Light & Power Company, Ltd., a holding company owning securities in several electric light and tramway properties in various parts of South America. The last two months were spent by Mr. White in motoring through France and Austria.

Mr. Howard G. Wilson has accepted the position of editor with the Underwriters' Laboratories, Chicago. Mr. Wilson was a student at Armour Institute of Technology, entering practical work in 1900. In 1909 he became connected with the Chicago Board of Fire Underwriters as electrical inspector, and after three years in this work entered the employment of Fred S. James & Company, an insurance firm, as traveling electrical engineer. This position he leaves to join forces with the Underwriters' Laboratories. Mr. Wilson has from time to time contributed to the periodical press articles on various subjects allied to electricity and insurance engineering.

Obituary

Andrew Sangster for many years superintendent of the municipal electric light department of the city of Sherbrooke, Quebec, died suddenly at his home on Nov. 9.

R. E. Bunning, an electrical expert, died at his home in Plainfield, N. J., Dec. 6, following an illness which began ten months ago in Lima, Peru, where he was engaged in constructing an electric light and power plant.

Dr. Henri Simon, chief of the radio-telegraphic service of Switzerland and a pioneer in the use of X-rays, died at Geneva, Switzerland, Dec. 9, a victim of these rays. He had endured many surgical operations, having lost one arm and part of the other.

William M. Finley, formerly news editor of the *Electrical World* and more lately an editorial writer on the *Wall Street Journal,* died at his home in New York on Dec. 7. Mr. Finley was born fifty-six years ago in Shelbyville, Ky., and was graduated from Monmouth College. He was at one time editor-in-chief of the Louisville *Dispatch* and managing editor of the Louisville *Post.* In 1895 he was assistant postmaster of Louisville.

George Henry Stout, a motor-service salesman in the contract department of the Commonwealth Edison Company, who died recently, was employed by Mr. Thomas A. Edison in the early days of electrical development. He obtained a position in the Edison laboratory in Menlo Park and was sent abroad when the first companies were organized in Europe. It is said that Mr. Stout did the original wiring in the Grand Opera House of Paris and in the residence of Baron Rothschild in that city. He remained abroad five years and afterward was engaged in electrical work in Louisville and Cincinnati, becoming connected with the Commonwealth Edison Company in 1905. Mr. Stout was fifty-six years of age.

Construction

New England

MORRISVILLE, VT.—Within the next six months the managers of the municipal electric-light plant expect to install one 1000-hp Leffel waterwheel, with Lombard governor, and one 750-kva Westinghouse generator and switchboard. Equipment has already been purchased. C. A. Slayton is superintendent.

STERLING, MASS.—Within the next six months the managers of the municipal electric-light plant expect to erect 3 miles of distribution lines to furnish electricity for commercial purposes; also to purchase an electrically operated pump (automatic control) for the municipal water system; also poles, transformers, wire, meters, etc., for above extension. H. W. Rugg is superintendent.

STOCKBRIDGE, MASS.—The Stockbridge Ltg. Co. expects to purchase within the next month complete equipment for a 100-kva substation and synchronous motor (three-phase, 60 cycles, 11,000/220 volts). Joseph Franz is engineer.

TURNERS FALLS, MASS.—The Franklin El. Lt. Co., of Turners Falls, has recently installed a new street-lighting system, consisting of 26 250-watt lamps on the main street and 116 75-watt lamps in the residential districts. The new contract is for a period of ten years from Nov. 1, 1913. Within the next six months the company expects to purchase general wiring supplies and line material for repairs (not a great amount). M. H. Mahoney is superintendent.

Middle Atlantic

CORNING, N. Y.—The Town Board has granted the Elmira Transmission Co. a franchise to erect transmission lines through the town for a period of 50 years. Under the terms of the franchise the company cannot distribute electricity in the town.

DUNKIRK, N. Y.—The Dunkirk El. Mfg. Co. expects to purchase within the next six months boilers having a rating of from 200 hp to 400 hp. H. T. Litchfield is secretary.

ELLENVILLE, N. Y.—The Ulster Lake Co., of Ellenville, expects to purchase within the next two months 900 ft. of 46-in. by 3/8-in. steel-riveted pipe and waterwheel governor. C. D. Divine is treasurer.

MARCELLUS, N. Y.—The owners of the Marcellus lighting plant expect to purchase some lightning arresters and transformers. F. W. Knapp is manager.

NEW YORK, N. Y.—Bids will be received by the superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Dec. 15 for installing electric equipment in new Public School 94 on Old House Landing Road, Cutter Avenue and Lafayette Place, Little Neck, borough of Queens.

OAKFIELD, N. Y.—The Public Service Commission has granted the Genesee Lt. & Pwr. Co., of Batavia, permission to purchase from the United States Gypsum Co., of Oakfield, the electrical distribution system in this village. The Public Service Commission has also approved the franchise given by the village of Oakfield to the Genesee company, permitting it to operate an electrical distribution system here. The company has also been awarded a five-year contract for lighting the streets of the village. The system will consist of forty 40-cp tungsten series lamps. Orders have been placed with the Westinghouse company and the General Electric Company for the necessary meters and transformers for changing the system from 133 cycles to 25 cycles. The system will be operated in connection with the transmission lines of the Genesee company which now run near this village. H. K. Stein is superintendent.

PORT HENRY, N. Y.—Within the next 30 days the Port Henry Lt., Ht. & Pwr. Co. expects to erect about 2 miles of distribution lines to maintain about 50 street lamps between Port Henry and Mineville. George H. Barwise is secretary.

SHERBURNE, N. Y.—Within the next 30 days the electric-light commissioners expect to erect about one-half mile of transmission line and to purchase some incandescent lamps. During 1913 a 200-hp Corliss engine and one 125-kva, 23,300-volt, two-phase, 60-cycle Crocker-Wheeler generator were installed in the municipal electric-light plant. William Champ is superintendent.

SOUTHAMPTON, N. Y.—The Suffolk Lt., Ht. & Pwr. Co., of Southampton, expects to erect transmission lines from Southampton to Bridgehampton. William B. Hambright is superintendent.

CENTERPORT, PA.—The Council has granted the Hamburg Gas & El. Co., of Hamburg, a franchise to erect a distribution system to furnish electrical service in this borough.

EXETER, PA.—The Borough Council has granted the Consumers' El. Co. a 60-year franchise in Exeter a contract for lighting the streets of the borough for a period of 10 years. The contract provides for Westinghouse arc lamps at $54 each per year. The Citizens' Illg. Co., of Pittston, holds the present contract. Exeter has not a post office.

FAIRVIEW, PA.—The contract for the electrical work in all the buildings for the State Hospital for the Criminal Insane, at Fairview, has been awarded to the Baird Ostherhout Co., 1112 Chestnut Street, Philadelphia, Pa.

HAMBURG, PA.—The Hamburg Gas & El. Co. expects to extend its system to the borough of Centerport to furnish electricity there and to purchase material for a distribution system for same. The company was recently granted a franchise in Centerport. A. J. Althouse is superintendent.

NEWCASTLE, PA.—The Standard Steel Car Co., of Newcastle, is reported to have abandoned its power plant and will secure electricity to operate its works from the Shenango & Mahoning Pwr. Co. The company is changing from direct to alternating current and is installing new equipment and machinery at a cost of about $50,000.

POTTSVILLE, PA.—Plans, it is reported, have been completed by the Eastern Pennsylvania Rys. Co., of Pottsville, for the erection of a new power plant at Palo Alto (a suburb of Pottsville), to cost about $350,000. This is to be an addition to its present power plant, located at the same place. A site has been acquired for the new plant.

READING, PA.—The Reading Merchants' Ice Co. has entered into a contract with the Metropolitan El. Co. for electricity to the amount of 300 hp to operate the machinery in its plant. Work will soon begin on the installation of electrical equipment at an early date.

RINGTOWN, PA.—Within the next three months the Ringtown El. Lt., Ht. & Pwr. Co. expects to erect a new steam power plant. J. A. Yost is secretary.

SCRANTON, PA.—The Scranton Ry. Co. has entered into a contract with the Scranton El. Co. whereby the latter will furnish electricity to operate the street-railway system of the former. It is estimated that from 4000 kw to 5000 kw will be required to operate the street-railway system.

TOMS RIVER, N. J.—Within the next four months the Toms River & Island Heights El. Lt. & Pwr. Co. expects to purchase a complete ice-manufacturing plant (from 10 to 20 tons capacity). C. A. Brant is general manager.

TRENTON, N. J.—The contract for the erection of a substation on Olden Avenue for the Public Service El. Co. has been awarded to Newton K. Bugbee and W. & J. H. Morris, of Trenton, at $12,000.

BUCKHANNON, W. VA.—The Buckhannon Lt. & Wtr. Co. expects to purchase within the next 30 days one 200-kw, three-phase generator and a 300-hp Bessemer gas engine (directly connected) and switchboard; also two 50-arc lamp transformers, 25 arc lamps and 100 incandescent-lamp fixtures. J. G. Mayfield is general manager.

FAIRMONT, W. VA.—The Fairmont & Clarksburg Pwr. Co., it is reported, contemplates the construction of two hydroelectric power plants, No. 1 to be situated at Valley Falls, 14 miles east of Fairmont, and No. 2 6 miles south of Grafton, to develop 10,000 hp and 50,000 hp respectively. The proposed work will include two power houses (40 ft. by 60 ft.), two concrete power dams and two (hollow-type reinforced concrete) storage dams, having a capacity of 1,500,000,000 cu. ft. The fall of No. 1 plant is 72 ft. and of No. 2 plant 290 ft., to be connected by a 14,000-ft. tunnel driven through coal seam. The equipment will consist of nine turbines directly connected to generators. Two substations will also be erected. J. S. Rex, of Monongah, W. Va., is secretary.

WARWOOD, W. VA.—The Brooke El. Co. has applied to the Commissioner of Ohio County for a 50-year franchise to erect transmission lines, cables and conduits for the transmission of electricity on several roads in the county. F. P. McNell is attorney for the company.

WILLIAMSON, W. VA.—Within the next two weeks the Williamson Lt. & Ice Co. expects to purchase one 100-hp, 2300-volt, 60-cycle, two-phase, 600-r.p.m. motor. The company has recently purchased a 30-ton ice machine to be driven by motor. O. B. Welch is vice-president and manager.

CULPEPER, VA.—The Culpeper Lt. & Ice Co. expects to purchase within the next four months a 150-hp water-tube boiler, a 10-in. by 30-in. Corliss engine, a 50-kw or 60-kw, 250-volt direct-current generator and rheostat, switches, etc. G. F. Major is superintendent.

ROYCE, VA.—Bids will be received by the Town Council until Jan. 5 for a franchise to install and operate an electric system in Royce for a period of 30 years. J. F. Stinson is acting Mayor.

STAUNTON, VA.—Within the next 30 days the Staunton Ltg. Co. expects to erect an outdoor substation at Fisherville to supply electricity to the rock quarries and crushers. Equipment has already been purchased. W. F. Ficklen, Jr., is superintendent.

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, D. C., until Dec. 15 for furnishing 14 ventilating blowers connected to 110-volt alternating-current, single-phase motors (right-hand); two ventilating blowers connected to 110-volt direct-current motors (left-hand); two 18-in. disk or propeller fans directly connected to 110-volt alternating-current, single-phase motors, complete, with starter; four 18-in. disk or propeller fans directly connected to 110-volt direct-current motors, complete, with inclosed starting rheostat and main switch (ready to run sets). Further information may be obtained upon application to Lt. Col. Joseph E. Kuhn.

WASHINGTON, D. C.—Bids will be received at Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 16 for furnishing at the various navy yards and naval stations the following supplies: Charleston, S. C., Schedule 6108—For one silent-chain drive with pulleys, eight electric diamond nose tailors' irons, two electric cutting knives, three miscellaneous motors, one electric stove, one three-pole knife switch and one switchbox for above. Bids will also be received

until Dec. 23 as follows: Brooklyn, N. Y., Schedule 6089—20,000 ft. double, flexible silk conductor; Schedule 6091—Miscellaneous electric dental engines, etc., seven electric dental sterilizers; Schedule 6089—11,000 ft. 10-conductor plain interior-communication cable, 10,000 ft. galvanized soft-steel leaded and armored twin-conductor wire, 6000 ft. plain twin-conductor wire; Schedule 6088—18,000 ft. stranded, portable ship-lighting cable, 40,000 ft. incandescent lamp cord, 7000 ft. stranded rubber-covered wire. Newport, R. I., Schedule 6093—Miscellaneous seamless copper tubing. Bids will also be received until Dec. 30 for the following: Brooklyn, N. Y., Schedule 6120—One 72-cell storage battery, 30 head-gears for radio receiving sets, one 7½-hp, 125-volt motor, complete. Philadelphia, Pa., Schedule 6116—Compressed cork for insulating purposes. Philadelphia, Pa., and Portsmouth, N. H., Schedule 6085—Miscellaneous seamless drawn tubing for condenser tube ferrules. Mare Island, Cal., Schedule 6085—22,000 lb. drawn brass seamless condenser tubes (admiralty mixture); Schedule 6084—Miscellaneous copper rod and bar, soft-rolled copper sheet; Schedule 6087—Miscellaneous brass and copper wire. Key West, Fla., Schedule 6112—One seven-panel switchboard. Boston, Mass., Schedule 6117—9000 lb. galvanized and annealed crucible cast-steel wire; Schedule 6083—8000 lb. brass voice tubing. Puget Sound, Wash., Schedule 6084—25,000 lb. ingot copper, grade No. 1. Bids will also be received until Jan. 6, 1914, as follows: Puget Sound, Wash., Schedule 6106—Electrically operated dishwashing machine. Tiburon, Cal., Schedule 6103—Two 75-hp induction motors and one switchboard panel. Mare Island, Cal., Schedule 6102—One motor-driven pump. Bids will also be received until Jan. 27, 1914, for furnishing at the navy yard, Brooklyn, N. Y., Schedule 6107—12 marine water-tube boilers, with tools complete. T. J. Cowie is paymaster general, U. S. N.

North Central

BARAGA, MICH.—Final surveys are being made for the proposed hydroelectric plant of the Sturgeon River Pwr. Co. on the Sturgeon River in Baraga. The present plans provide for the construction of three dams on the Sturgeon River, two power houses, 8 miles of pipe line and 35 miles of electric transmission lines. When completed, the plant will furnish energy to more than a dozen towns and cities in Michigan. J. K. Gronholdt, of New York, N. Y., is chief engineer of the company.

DETROIT, MICH.—Arrangements are being made by the Eastern Edison El. Co., of Detroit, to extend its transmission line from its power house in Detroit to the towns of Warren and Centerline to furnish electrical service in those towns. The town of Warren has contracted for the installation of 50 tungsten lamps of 100 cp. The cost of the work is estimated at $35,000.

DOWAGIAC, MICH.—The Electric Light Commission expects to purchase within the next six months a condensing engine and possibly a 100-kw alternating-current generator and some poles. William E. Reynolds is contract agent and superintendent.

LAKEVIEW, MICH.—The Lakeview El. Lt. Co. expects to change its plant to three-phase system, which will necessitate the purchase of a new or second-hand generator.

MARSHALL, MICH.—Plans are being prepared, it is reported, by the Commonwealth Pwr. Co., of Jackson, for the erection of a substation in Marshall. This staton will furnish electricity to operate the cars of the Michigan United Trac. Co., of Jackson.

RICHMOND, MICH.—The Marquette County Gas & El. Co., of Ishpeming, Mich., has been awarded a contract to install a street-lighting system in Richmond, consisting of fifty 100-watt lamps.

SAGINAW, MICH.—The Saginaw Ammonia & Blueing Co., it is reported, contemplates the construction of an addition (50 ft. by 20 ft., one story) to its plant to provide space for the installation of an electric and steam plant, to be used for distilling purposes.

BARBERTON, OHIO.—The City Council has adopted a resolution authorizing the director of public safety to purchase a site for a proposed substation for the municipal electric-light plant. Bids for equipment for the substation will soon be called for. William S. Mitchell is Mayor.

CLEVELAND, OHIO.—The F. Zimmerman Co., 1723 Leonard Avenue, Cleveland, molding manufacturer, it is reported, expects to purchase equipment for its power plant now being built at 2198 West 110th Street, Cleveland.

CLEVELAND, OHIO.—The City Council has authorized the expenditure of $18,504 for the purchase and installation of 18 transformers (500 kva) and $37,000 for cable to be used in connection with the municipal electric-light plant. W. J. Springborn is director of public service.

CLEVELAND, OHIO.—Approximately 15 miles of overhead wires will be placed underground by the public utility corporations next year, according to the schedules submitted to the director of public service and the special investigating committee of the City Council. W. J. Springborn is director of public service.

CLEVELAND, OHIO.—Plans are being prepared by the National Telephone Sup. Co., of Cleveland, for the construction of a manufacturing plant in Cleveland, to cost about $60,000, for which bids for construction will be received Feb. 14. Machinery, with the exception of lighting and power plant, motors and transmission equipment, has been selected. Light and power will be supplied from the same unit, which will be driven by a natural gas engine of approximately 100 hp. Richardson & Yost, 354 Rockefeller Building, Cleveland, are architects and engineers.

CLEVES, OHIO.—Bids will be received at the office of R. R. Robinson, village clerk, until Dec. 15 for lighting the streets, alleys and public places with electricity for a period of ten years.

NEW BREMEN, OHIO.—Bids will be received by the City Council until Jan. 10 for one motor-driven water pump, working against a head of 46 lb. and a maximum pressure of 100 lb. E. R. Haines is city clerk.

SWANTON, OHIO.—The County Commissioners have granted the Swanton Lt. & Pwr. Co. permission to erect transmission lines through a corner of Lucas County. The company proposes to extend its service to Neapolis.

FLEMINGSBURG, KY.—The Flemingsburg Lt. & Ice Co. expects to purchase within the next six months a 150-hp engine and 100-kw direct-current generator (directly connected) and one 72-in. by 18-ft. return tubular boiler. C. E. Cooper is secretary and manager.

PIKEVILLE, KY.—Within the next six months the Sandy Valley Lt. & Pwr. Co., of Pikeville, expects to change its entire plant from 220 volts, direct current, to 2200-110 volts, 60 cycle, alternating current, including 40,000-to-2200 volt switching apparatus and transformers. The company also expects to purchase within the next six months about 250 meters, a complete lightning-arrester equipment for 2200 volts, a complete series tungsten street-lighting outfit, and electrical appliances and supplies necessary for this change. L. L. Stone is general manager.

EDINBURG, IND.—A special election will be held on Dec. 30 to vote on the proposal to issue bonds for improvements and extensions to the municipal electric-light and water plants.

GARRETT, IND.—The city of Garrett is contemplating the construction of a concrete and steel chute at the water and light plant and the installation of additional equipment, including a 200-hp boiler, an engine and generator (directly connected). W. W. Mountz is city clerk.

TIPTON, IND.—The city of Tipton may possibly purchase a turbine for the municipal electric-light plant and overhaul the distribution system. Arthur C. Herren is superintendent.

WILLIAMS, IND.—The Southern Indiana Pwr. Co., of Bedford, has applied to the Public Service Commission for permission to issue $500,000 in capital stock, the proceeds to be used to pay off floating indebtedness, purchase more land, and for extensions to its plant. The company's plant is located in Williams, which furnishes electrical service in a number of towns in this vicinity, including Bedford and Oolitic. Horace C. Stillwell, of Anderson, is president.

EARLVILLE, ILL.—The Village Board has decided to install a new street-lighting system in Earlville.

ERIE, ILL.—The Village Board has granted the Illinois Northern Utilities Co., of Chicago, a 25-year franchise to operate in Erie and also a 10-year contract for lighting the streets of the village.

GILLESPIE, ILL.—The City Council has instructed the light committee to prepare plans for improving the street-lighting system in the business section of the city.

KEWANEE, ILL.—City Commissioner Dunbar has announced that new equipment will be required for the municipal water-works station. The commissioner, it is understood, favors equipping the pumping station for electrical operation.

LODA, ILL.—The local electric-light plant, owned by Matthew Coffey, has been purchased by the Central Illinois Utilities Co., of Paxton, Ill.

MONMOUTH, ILL.—The Monmouth Pub. Serv. Co., it is reported, contemplates improvements to its plant, including the installation of a 750-kw turbo-generator. The company also proposes to rebuild its ice plant.

OREGON, ILL.—An issue of $7,000 in bonds is contemplated by the city of Oregon for the purpose of making repairs to the dam across the Rock River here, where it is proposed to establish a power plant.

PANA, ILL.—W. H. Suffern, of Decatur, has submitted a proposal to the City Council asking for a 20-year franchise to construct and operate an electric-lighting system in Pana. If granted a franchise he will install a new plant. Mr. Suffern agrees to furnish 2000-cp arc lamps for street-lighting at $50 each per year.

PEORIA, ILL.—Plans have been submitted by the Association of Commerce to the city of Peoria for remodeling the Coliseum, which includes the installation of a new lighting system.

SPRINGFIELD, ILL.—Mayor John S. Schnepp has introduced an ordinance in the City Council providing for the purchase of a generator and a 400-hp boiler for the municipal electric-light plant. This is a separate plan from the ordinance for the purchase of a generator to be installed at the municipal water-works station to provide electricity for lighting the streets and for power purposes.

WASHBURN, ILL.—The Washburn Ht., Lt. & Pwr. Co. is contemplating the installation of a 5-ton to 10-ton ice plant in connection with its central station before the next season for ice opens. W. E. Lycan is president and manager.

BARRON, WIS.—Within the next three months the managers of the municipal electric-light plant expect to purchase one 125-hp to 150-hp oil or steam engine and one 120-hp waterwheel and governor. Series tungsten street lamp fixtures will be purchased next spring to replace the arc lamps now in use. E. H. Jackel is superintendent.

FALL CREEK, WIS.—The village of Fall Creek is contemplating the construction of a municipal electric-light plant. The proposed plant will be driven by water-power.

LAKE MILLS, WIS.—Within the next 30 days the managers of the municipal electric-light plant expect to erect 3 miles of 6600-volt transmission line, material for which has already been purchased. B. C. Engsberg is superintendent.

NEW LONDON, WIS.—The Electric Light and Water Commission expects to build within the next five months a concrete reservoir and pumping station for pure water supply. Within the next three months the commission expects to purchase two 125-kw to 200-kw, three-phase, 2300-volt generators (directly connected) and one six-circuit switchboard for above. O. H. Pribnow is superintendent.

RANDOLPH, WIS.—Bids will be received by J. O. Jones, village clerk, for the installation of an engine and dynamo, including labor and material, until Dec. 15, in accordance with plans and specifications prepared by the Langstadt-Meyer Construction & Supply Co., of Appleton, Wis., which may be seen at the office of the village clerk.

CARLTON, MINN.—Bids will be received by the Board of County Commissioners of Carlton County, Carlton, until Jan. 6 for the construction of jail and sheriff's residence in Carlton, according to plans and specifications prepared by Vernon J. Price & Co., architects, Palladio Building, Duluth. Separate bids are to be submitted as follows: On general contract work, plumbing, heating, wiring and cell work. Plans are on file in the office of August R. Norman, county auditor, Carlton, and at the offices of the architects in Duulth or Rexall Block, Crosby, Minn.

CHASKA, MINN.—Within the next six months the Electric Light Commission expects to purchase a coal-handling system to unload cars. E. F. Strang is manager.

ROCHESTER, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Dec. 17 for electrical construction for power plant at the Rochester State Hospital, Rochester, in accordance with plans and specifications, prepared by Charles L. Pillsbury Co., engineer, Metropolitan Life Building, Minneapolis, Minn. Copies of plans and specifications may be seen at office of the superintendent, State Hospital, Rochester, at the Builders' Exchange in Minneapolis and St. Paul, at the office of the State Board of Control and at the office of the engineer. Bids will also be received at the same time and place for the installation of a telephone system and watchman's clock system for the Rochester State Hospital. Bids must be submitted on forms supplied by the engineers.

ST. PETER, MINN.—Within the next six months the Electric Light and Water Department expects to erect additional distribution lines, to cost about $3,000, and to purchase a 150-kw or 200-kw generator and turbine or engine. F. N. Wilson is superintendent.

BAGLEY, IA.—The contract for equipment for the municipal electric-light plant has been awarded to the Globe Electrical Co. of Milwaukee, Wis., for $5,325. The proposed plant will be driven by a 30-hp crude-oil engine.

DENISON, IA.—The installation of a municipal electric-light plant in Denison is under consideration.

GARNER, IA.—The Enterprise El. Lt., Ht. & Pwr. Co., of Garner, expects to purchase within the next six months a generator and engine.

PILOT MOUND, IA.—At an election held recently the proposal to establish a municipal electric-light plant was carried.

KANSAS CITY, MO.—Bids will be received by Henrici, Kent & Lowry Engineering Co., 715 Reserve Bank Building, Kansas City, Mo., consulting engineers, until Dec. 18 for equipment for the new power plant of Montgomery, Ward & Co., of Kansas City. Bids will also be received until Jan. 15 for excavations, for furnishing and installing one trash-burning furnace, piping, breeching, coal and ash-handling apparatus, power-plant wiring and pipe covering. For details see proposal columns.

KIRKWOOD, MO.—Within the next six months the managers of the municipal electric-light plant expect to purchase new equipment, including engines, boilers and generators for a 300-kva plant, and they would like to receive estimates of cost on same. They also purpose to install a 10-ton ice plant in connection with the electric plant. W. A. Trussell is superintendent.

MONROE CITY, MO.—Within the next six months the managers of the municipal electric-light plant expect to establish a day service. O. R. Emerson is superintendent.

ST. LOUIS, MO.—The advertisement requesting bids to be opened Dec. 20 for plumbing and wiring for the extension to the United States public building in St. Louis, Mo., has been withdrawn by O. Wenderoth, supervising architect.

COGSWELL, N. D.—The Cogswell El. Lt. & Pwr. Co. expects to purchase within the next six to eight months a 15-hp gasoline engine and a direct-current generator. H. L. Saylor is secretary.

GREGORY, S. D.—The plant of the Gregory Lt. & Pwr. Co. was recently destroyed by fire, causing a loss of from $12,000 to $15,000.

VALLEY, NEB.—Within the next few months the managers of the municipal electric-light plant expect to purchase a few meters and two coils of weatherproof wire. Albert C. Hedberg is village clerk.

CAWKER CITY, KAN.—The city of Cawker does not propose to construct a municipal electric-light plant as reported in the issue of Nov. 22. The proposed bond issue is for the purpose of purchasing the local electric-light plant. C. R. McKinley is city clerk.

SABETHA, KAN.—The managers of the municipal electric-light plant are plannning to rebuild the distribution system, material for which has already been purchased; the installation of an ornamental street-lighting system is also under consideration. A 187-kva, three-phase, 60-cycle, 2300-volt Westinghouse turbine has recently been installed. F. W. Hunter is general superintendent.

WATHENA, KAN.—Within the next three months the managers of the municipal electric-light piant expect to purchase one car load of 30-ft. white cedar poles. F. A. Whitney is superintendent.

Southern States

DANBURY, N. C.—The installation of an electric-light plant is under consideration by the Town commissioners.

GREENVILLE, N. C.—A committee, consisting of Aldermen Rountree, A. B. Ellington and Fire Chief D. D. Overton, has been appointed by the Board of Aldermen to make investigations in regard to the cost of proposed improvements to the water and light plants and the installation of a fire-alarm system for the town. The cost of the work is estimated at $25,000.

NEWBERN, N. C.—The Municipal Water and Light Department expects to complete within the next two months the power station for the light and water plants; also to purchase within the next six months one 500-kw, 2300-volt, three-phase steam generating unit (directly connected). Two 50-lamp, 6.6-amp rectifiers outfits and luminous-arc lamps manufactured by the General Electric Co. have recently been installed. H. H. Hodges is superintendent.

PICKENS, S. C.—Within the next two months the Ivy Wtr., Lt. & Pwr. Co., of Pickens, expects to purchase a set of meters. A. M. Morris is president.

WOODRUFF, S. C.—The City Council is contemplating the installation of an electric-lighting system.

PUNTA GORDA, FLA.—At an election held Dec. 2 the proposal to issue $60,000 in bonds for extensions to electric-light, water and sewer systems was carried. George S. Stone is president of Council.

CARROLLTON, ALA.—The City Council has granted the Delma Lumber Co. a franchise to construct and operate an electric-light plant in Carrollton for a period of 20 years. George M. Collins and Dr. H. H. Mobley, of Gordo, are interested in the project.

CARROLLTON, MISS.—The managers of the municipal electric-light plant expect to extend the municipal electric-light system through North Carrollton within the next six months and will purchase poles and line material for same. W. E. Stilson is manager.

NATCHEZ, MISS.—Bids will be received until Dec. 17 by the city of Natchez for lighting the streets of the city for a period of five years. Specifications are on file in the office of the city clerk.

BATESVILLE, ARK.—The city of Batesville has just completed a new reinforced concrete power house (100 ft. by 50 ft.) and a concrete coal bin of 600 tons capacity and the installation of a 150-kw Fort Wayne alternating-current generator. Within the next week the electric light and water commission expects to purchase electrical heating and cooking apparatus for the holiday trade. W. H. Walkup is superintendent.

BEEBE, ARK.—The A. C. Ward El. Co., of Beebe, is contemplating extending its service to Cabot, Ward, McRae and possibly to other nearby towns.

TEXARKANA, ARK.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 5 for a conduit system and lighting fixtures in the United States post office and court house at Texarkana. For details see proposal columns. O. Wenderoth is supervising architect.

MANSFIELD, LA.—Within the next four months the Mansfield Ice Co., Ltd., expects to purchase 75 110-volt, 60-cycle meters.

NEW ORLEANS, LA.—Bids will be received by the Sewerage and Water Board, Room 508, City Hall, City Hall Annex, New Orleans, until Jan. 30, for furnishing electrical machinery under Contract 59-D; also for drainage canal work under Contract 60-D. Specifications for both contracts furnished upon application, upon the deposit of $50 and $10 respectively. Bids will also be received by the Sewerage and Water Board, fifth floor, City Hall Annex, New Orleans, until Jan. 6 for pumps and flood gates, under Contract 58-D, plans for which will be furnished on deposit of $500. George G. Earl is general superintendent and F. S. Shields is secretary.

CUSHING, OKLA.—The Cushing El. Lt. & Pwr. Co. has recently purchased a 16-in. by 36-in. Harris Corliss engine, one 150-kva, three-phase, 60 cycle Allis-Chalmers generator, and a three-panel switchboard. The company is now installing 25 100-watt tungsten street lamps. H. Askin is secretary.

HUGO, OKLA.—The property of the Hugo Ice & Lt. Co. has been purchased by the American Pub. Ser. Co., of New York, N. Y. Extensive improvements are contemplated to the system. H. E. Mole, 55 Liberty Street, New York, N. Y., is chief engineer of the American Pub. Ser. Co.

McALESTER, OKLA.—Plans are being made by the Pioneer Tel. & Tel. Co. to rebuild its local system at a cost of $38,000. Elmer Speaker is local manager.

ARANSAS PASS, TEX.—At an election held recently the citizens voted to issue $8,000 in bonds for the construction of an electric-light plant.

COOPER, TEX.—The Delta El. & Mfg. Co., of Cooper, expects to purchase within the next four months one 125-hp boiler; also to purchase at once a rectifier to charge batteries for automobiles. The company would like to purchase an appliance for control of street lamps (lamps are in multiple and on main wires) and if possible would like equipment to control them without extra wires. R. J. Thomas is president.

HAMILTON, TEX.—H. M. Weiser, who recently purchased the property of the Hamilton Lt. & Pwr. Co., is enlarging and improving the power plant. New machinery is now being installed.

HICO, TEX.—Within the next two months the Hico El. Lt. & Pwr. Co. expects to erect 22 miles of transmission from Hico to Walnut Springs. H. Gleason is manager.

HOUSTON, TEX.—The Houston El. Co. is contemplating extending its street-railway system to Sunset Heights, a distance of 4 miles.

Pacific States

CATHLAMET, WASH.—Ingalls Brothers, of Cathlamet, who were recently granted a 25-year franchise by the City Council to construct and operate an electric-light system in Cathlamet, have agreed to install the system within six months.

GRANITE FALLS, WASH.—The Granite Falls El. Co. expects to purchase 1½ miles of No. 6 bare copper wire within the next two months. C. H. Cleaver is secretary and treasurer.

SEATTLE, WASH.—Under an executive order of President Wilson, 1120 acres of unsurveyed land belonging to the government on Illabot Creek, Skagit County, were recently withdrawn from entry and will be reserved for a water-power site.

SPOKANE, WASH.—The stockholders of the Washington Wtr. Pwr. Co. have approved the proposed increase of capital stock from $15,000,000 to $20,000,000. The proceeds will be used to take care of outstanding indebtedness and for future construction work.

BEND, ORE.—The Bend Wtr. Wks., Lt. & Pwr. Co. is contemplating the installation of an ornamental street-lighting system in Bend. Property owners on Bond, Oregon and Wall Streets are agitating the installation of an ornamental lighting system in those districts.

PORTLAND, ORE.—The contract for the construction of the power plant in the Pittock Block has been awarded to the Charles C. Moore Co., 99 First Street, San Francisco, Cal., at about $80,000.

PORTLAND, ORE.—The Portland Ry., Lt. & Pwr. Co. expects to install within the next few months several arc lighting sets and a considerable number of magnetite-arc lamps for city lighting. O. B. Coldwell is general superintendent of Light and Power Department.

ANAHEIM, CAL.—The Anaheim Board of Trade is considering the question of lighting the state highway from Fullerton to Santa Ana, a distance of 11 miles. The associated chambers of commerce of Orange County has been asked to appoint a committee to promote the project.

LOS ANGELES, CAL.—The board of experts, consisting of George L. Hoxie, of New York, N. Y.; Prof. C. L. Cory, of Berkeley, and C. W. Koiner, of Pasadena, employed by the City Council to investigate and report on the cost of the electrical distribution system for aqueduct, has submitted its report to the Council. The cost of a system to furnish electrical service to the entire city, exclusive of the electric railways, is estimated at $5,697,635; the cost of operating such a system would be $1,283,716 per year; the annual income the city would receive from the operation of such a system is estimated at $2,029,000. The report provides for reaching every customer in the city and distributing a peak load of approximately 36,000 hp.

SAN BERNARDINO, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, it is reported, is contemplating the construction of a transmission line from San Bernardino to Benning, to cost about $400,000.

SAN DIEGO, CAL.—The City Council has awarded the contract for the installation of ornamental lamp standards on Third Street to the Howell El. Co., at $4,330; the company was also awarded the contract for a lighting system on F Street, to cost $4,950. The city will construct a lighting system on Seventh Street, to cost about $6,100.

MIDVALE, IDAHO.—The Adams County Lt. & Pwr. Co. has applied to the City Council for a franchise to construct and operate an electric-light and power plant in this city.

HARDIN, MONT.—At an election held recently the citizens voted to grant a franchise to E. A. Crowell and B. Blum to construct and operate an electric-light plant.

SHERIDAN, WYO.—An agreement has been reached between the city and the Sheridan County El. Co. for the installation of an ornamental street-lighting system in Sheridan. The present plans provide for the erection of 66 standards carrying five-lamp clusters.

EAGLEWOOD, COL.—The City Council is considering the installation or purchase of an electric-lighting system.

LAS VEGAS, NEV.—An order has been issued by Secretary Lane of the Department of the Interior creating a power site reserve in Boulder Canyon, on the Colorado River, 20 miles east of Las Vegas. It is estimated that 40,000 hp can be developed.

Canada

MEDICINE HAT, ALTA.—Two of the by-laws recently passed by the burgesses of Medicine Hat provide for the necessary expenditure for extensions and improvements to the municipal electric-light and gas systems.

KERRISDALE, B. C.—The establishment of a municipal electric-light plant is being agitated by the Kerrisdale Ratepayers' Association.

LILLOOET, B. C.—The Lillooet Lt. & Pwr. Co., it is reported, will soon begin work on the construction of a hydroelectric power plant near Lillooet.

NELSON, B. C.—The City Council is contemplating the installation of a tungsten street-lighting system, to cost about $16,000.

CARBERRY, MAN.—The town of Carberry expects to change the street-lighting system from series arc lamps to series tungsten lamps and to install additional lamps. M. J. Melville is town electrician.

NIAGARA FALLS, ONT.—Plans are being considered for building a tunnel from the Whirlpool to the Lewis escarpment, a distance of 3 miles. If the plan is carried out, about 30,000 hp will be developed at the foot of Lewiston Heights. E. B. Reed, of Lockport, N. Y., is interested.

ST. CATHARINES, ONT.—The City Council on Dec. 1 ratified the by-law to expend $116,000 for the installation of a distributing system for electricity to be supplied by the Hydro-Electric Power Commission and also indorsed the agreement with the commission.

SAULT STE. MARIE, ONT.—The Tagona Wtr. & Lt. Co. has notified the City Council that it will not ask for a renewal of its franchise.

AYER'S CLIFF, QUE.—The Sherbrooke Ry. & Pwr. Co., of Sherbrooke, has acquired the property of the Burrows Falls Pwr. Co., thus securing a franchise to furnish electricity for municipal and commercial purposes in the town.

PRINCE ALBERT, SASK.—The Council has decided to engage an engineer to make investigations and report on the possibilities of obtaining power from Lacolle Falls.

WOLSELEY, SASK.—The managers of the municipal electric-light plant expect to erect a second primary line in town within the next 30 days; also to purchase within the next two months washing machines, electric irons, heating and cooking apparatus. The town has recently purchased the property of the Central Lt. & Pwr. Co. Charles Stengell is manager.

YORKTON, SASK.—The managers of the municipal electric-light plant expect to purchase within the next two months one 500-hp generating unit (Diesel engine), tenders for which will be received until Dec. 22; also within the next six months to purchase 65 ornamental lamp standards for five-lamp clusters. Contract has been awarded for the erection of a new power house to Messrs. Walker & Ritchie, of Portage la Prairie, Man. M. M. Inglis is electrical engineer.

DAWSON, YUKON TERRITORY.—A movement has been started to establish municipal ownership of water service, electric lighting, telephones and other public utilities, through the Dawson Civic League, which was recently organized. Committees have been appointed to secure data in regard to the cost of municipal installation and operation of same.

Miscellaneous

VALDEZ, ALASKA.—The City Council has granted Alfred B. Iles, of Valdez, a franchise to erect transmission lines for the distribution of electricity over the principal streets of the city.

New Incorporations

RUPERT, IDAHO.—The Star El. Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by J. P. Puckett, Harry H. Shillington and Jay N. Shaver.

PORTLAND, MAINE.—The Central Iowa Lt. & Pwr. Co. has filed articles of incorporation under the laws of the State of Maine. The company is capitalized at $300,000 and proposes to construct, maintain and operate power plants for the supply and distribution of electricity for all purposes. A. F. Jones is president and T. L. Croteau treasurer, both of Portland.

BETHANY, MO.—The Bethany Tel. Co. has been incorporated with a capital stock of $50,000 by W. M. Foster, John A. Lilly and O. H. Nally.

PHOENIX, N. Y.—The Phoenix Gas & El. Co. has been incorporated with a capital stock of $40,000 by Herbert Dunn, J. A. Haws and L. M. Hutchinson, all of Phoenix. The company proposes to furnish electricity and gas for lamps and motors in Phoenix.

CLEVELAND, OHIO.—The Utilities Service Co. has been incorporated with a capital stock of $10,000 by John Anderson, Joseph E. Kewley and Charles W. Louder.

CONDE, S. D.—The Conde Lt. & Pwr. Co. has been incorporated with a capital stock of $15,000 by M. Ehler, Caroline Raylor and George J. Ehrier, all of Conde.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 2, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,079,931. MICROPHONE; J. J. Comer, Chicago, Ill. App. filed Nov. 28, 1910. Differential type with carbon diaphragm; voice vibrations directed to marginal portion of the diaphragm.

1,079,946. TROLLEY FINDER; P. J. Minck, Brooklyn, N. Y. App. filed May 31, 1909. Eccentrically mounted hollow finder drums at opposite sides of trolley wheel.

1,079,948. FUSE PLUG; T. E. Murray, New York, N. Y. App. filed July 24, 1913. Fuse strip doubled over a supporting partition, engaging the screw shell at one end and the other end passed out through center of plug.

1,079,991. ELECTRICALLY CONTROLLED RAILWAY SWITCH; E. S. Olmsted, Beechmont, Ky. App. filed March 22, 1913. Trolley wheel first opens and then closes the circuit of the electrically operated switch-throwing device.

1,079,994. COMMUTATOR MOTOR; H. K. Schrage, Vesteras, Sweden. App. filed Sept. 9, 1911. Induction-motor type; speed regulated by brush displacement.

1,080,005. ELECTRIC WATER PURIFIER; L. A. Fitzer, Los Angeles, Cal. App. filed March 15, 1913. Plates held spaced by being seated in grooves in the bottom board of the tank.

1,080,018. ELECTRICAL COMMUNICATING SYSTEM; L. N. Miller, Rochester, N. Y. App. filed March 17, 1909. System over which fire-alarm reports or calls may be sent or telephonic communications may be maintained.

1,080,026. MOTOR-REVERSING MEANS; H. B. Taylor, Wilkinsburg, Pa. App. filed Feb. 23, 1912. One side of armature is connected to an intermediate point in the field winding, and switch serves to connect other side of armature to either of the two terminals of the field winding.

1,080,028. TYPEWRITING MACHINE; C. H. Vogel, Vancouver, B. C., Canada. App. filed Aug. 22, 1910. Electromagnet completes the stroke of the type bar started by the finger key.

1,080,029. ELECTRIC GENERATING TRANSMITTING AND DISTRIBUTING SYSTEM; F. W. Walker Port Washington, Wis. App. filed Nov. 27, 1911. An auxiliary engine has a driving connection with the rotary element of the transformer, which is connected with the transmission line.

1,080,044. ELECTRICALLY OPERATED REVERSING GEAR; K. Brüll, Budapest, Austria-Hungary. App. filed Feb. 27, 1912. An auxiliary motor switches the gear into the three main positions of rotation to the left, stoppage and rotation to the right.

1,080,051. ELECTRIC LOCOMOTIVE; G. M. Eaton, Wilkinsburg, Pa. App. filed June 9, 1910. Has trussed side frames.

1,080,058. SWITCH; G. W. Hart, West Hartford, Conn. App. filed April 1, 1913. Foot-operated starting switch for automobiles.

1,080,061. INDUCTION MOTOR; R. E. Hellmund, Pittsburgh, Pa. App. filed Jan. 7, 1911. Particularly for locomotives; circuit changes accomplished through three slip-rings and an externally actuated switching device located within the revolving part.

1,080,088. AUTOMATIC SIGNALING AND TRAIN-STOPPING COMBINATION CIRCUIT DEVICE; C. C. Turner, Portland, Ore. App. filed May 27, 1912. Electromechanical contrivances on the moving vehicle engage with a third-rail.

1,080,113. HEATING MOLTEN ELECTROLYTES; F. Von Kugelgen, Holcombs Rock, Va., and G. O. Seward, East Orange, N. J. App. filed March 28, 1911. Gaseous combustible is burned within a hollow electrode.

1,080,126. CONTROLLER FOR ELECTRIC MOTORS; H. F. Stratton, Cleveland, Ohio. App. filed June 20, 1912. Alternating-current controller with magnet whose winding always takes a small amount of current regardless of the position of the controlling device.

1,080,140. MOTOR-CONTROL SYSTEM; C. S. Dauler, Cleveland, Ohio. App. filed July 24, 1913. Partial manual and automatic control.

1,080,146. MOTOR-CONTROL SYSTEM; J. H. Hall, Cleveland, Ohio. App. filed March 18, 1913. Safety limit switch stops motor when mechanism driven thereby reaches certain limit of movement.

1,080,161. INDICATOR MECHANISM; E. J. Pace and O. E. Kellum, Los Angeles, Cal. App. filed Dec. 13, 1911. Station indicator.

1,080,167. MEANS FOR ELECTRICALLY TRANSMITTING ORDERS OR SIGNALS AND FOR INDICATING THEIR NATURE AND THE POINTS OF TRANSMISSION; H. Quertier, Wellington, New Zealand. App. filed Sept. 2, 1910. For transmitting orders from the tables in a restaurant to the kitchen or servery.

1,080,200. ALTERNATING - CURRENT - MOTOR CONTROLLER; C. A. Dresser and H. Fankboner, Chicago, Ill. App. filed July 2, 1909. Remote control alternating-current motors by means of alternating-current apparatus.

1,080,214. REGULATOR FOR ELECTRIC FLUID HEATERS; W. S. Hadaway, Jr., New York, N. Y. App. filed Sept. 5, 1911. Fluid-in-circuit heater which is adjustable with respect to the supply vessel so as to vary the level of the liquid therein.

1,080,230. ELECTRICAL SLIDING CONTACT; J. V. Purssell, Friendship Heights, Md. App. filed Dec. 12, 1912. Re-bent spring body with insulator finger holds which may be gripped to lift the contact from engagement with the tuning coil or other device.

1,080,234. DRY-CELL BATTERY; A. Rordame, Salt Lake City, Utah. App. filed May 14, 1913. Insulated screen packing with obliquely disposed interstices is interposed between the metal container and the bibulous lining.

1,080,236. WEIGHING SCALE; J. L. Saylor, Minneapolis, Minn. App. filed July 25, 1910. Scale movable on track beneath the discharge openings in a commodity cabinet, and the scale beam controls the electromagnetic discharge valves.

1,080,237. WEIGHING SCALE; J. L. Saylor, Minneapolis, Minn. App. filed July 24, 1911. Electromagnetically controlled discharge valve under control of a scale beam.

1,080,246. CONTROLLING SYSTEM FOR SIGNALING CIRCUITS; C. E. Beach, Binghamton, and H. W. Doughty, New York, N. Y. App. filed Oct. 31, 1910. Fire-alarm and police-telegraph system.

1,080,247. BATH CABINET; M. Beadle, Battle Creek, Mich. App. filed June 29, 1912. Foldable and practically air-tight.

1,080,257. INSULATOR; K. Bruchsaler, San Francisco, Cal. App. filed May 5, 1913. Porcelain tube with retaining strip insertable with the tube and bendable to hold tube in place.

1,080,260. INTERCOMMUNICATING TELEPHONE SYSTEM; P. G. Burgess, Jamaica, N. Y. App. filed Sept. 29, 1910. Includes dictagraph installation.

1,080,271. ART OF SIGNALING BY ELECTROMAGNETIC WAVES; R. A. Fessenden, Brant Rock, Mass. App. filed May 4, 1906. Tunes by varying both the coupling and the amount of wire in each coil of the transformer by infinitesimal increments.

1,080,287. SIGNALING DEVICE; M. Levison, Chicago, Ill. App. filed May 19, 1911. Annunciator is actuated only upon maintenance of the changed conditions in the main circuit for a predetermined lapse of time.

1,080,321. PRINTING MACHINE; G. M. Breckenbridge, Chicago, Ill. App. filed Nov. 4, 1912. Motor drives through interposed clutch; automatic means to break circuit and disconnect clutch.

1,080,323. AUTOMATIC FIRE ALARM; L. J. Bryant and J. Case, Bradford, Pa. App. filed March 19, 1913. Fusible link holds one arm of a spring yoke out of engagement with a contact post.

1,080,325. ATTACHMENT PLUG FOR ELECTRIC CIRCUITS; F. H. Chapman and O. E. Kenney, Toledo, Ohio. App. filed Feb. 24, 1913. Plug member of the coupling has a spring-pressed center-contact plunger.

1,080,326. ATTACHMENT PLUG FOR ELECTRIC CIRCUITS; F. H. Chapman and O. E. Kenney, Toledo, Ohio. App. filed Feb. 24, 1913. Plug with spring-pressed plunger; brush on plunger makes sliding engagement with a contact on the plug and serves also to limit movement of the plunger.

1,080,327. ATTACHMENT PLUG FOR ELECTRIC CIRCUITS; F. H. Chapman and O. E. Kenney, Toledo, Ohio. App. filed March 21, 1913. A pivoted dog on the plug is thrown out into engagement with the screw of the socket when plug is inserted all the way in the socket.

1,080,339. THERMOSTATIC CIRCUIT CLOSER; J. Hartley, Philadelphia, Pa. App. filed Sept. 21, 1908. Fusible element holds spring-pressed contact disk out of engagement with a relatively fixed contact disk.

1,080,344. PROCESS OF SMELTING METALS; J. D. Hillard, Albany, N. Y. App. filed Nov. 26, 1907. Continuously feeding and operating preheating kiln in combination with one or more electric furnaces.

1,080,354. FIRE-ALARM SIGNAL BOX; W. J. Leveridge, Plainfield, N. J. App. filed March 12, 1913. Applies "break-glass" principle to an ordinary pull-lever type of fire-alarm box.

1,080,355. SYSTEM OF ELECTRICAL DISTRIBUTION; J. O. Luthy, San Antonio, Tex. App. filed Feb. 26, 1913. Supplies current at voltage in excess of that normally required by the translating devices, successively varies the voltage between predetermined limits and rapidly reverses the order of voltage variation.

1,080,387. BRAKE FOR ELECTRIC-MOTOR-OPERATED MACHINES; M. Taigman, New York, N. Y. App. filed March 24, 1913. Combines brake with the starting box.

1,080,388. ELECTRIC-MOTOR DRIVING UNIT; M. Taigman, New York, N. Y. App. filed March 24, 1913. Motor unit supplied as an individual portable member ready for immediate installation.

1,080,403. MEANS FOR COMPENSATING POLYPHASE ALTERNATING-CURRENT COMMUTATOR MOTORS; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 28, 1912. Drum winding connected to one side of the source of supply and the commutator brushes connected to the other side of the source.

1,080,405. BALL JOINT; L. W. Andersen, Waterbury, Conn. App. filed Sept. 6, 1913. Relatively movable hemispherical shells containing guard plates protecting the wiring.

1,080,410. SHOE OR SKATE FOR ELECTRIC RAILWAYS; A. W. Barnhart, Cairo, W. Va. App. filed Jan. 31, 1913. Collector yieldingly supported between pole pieces of an electromagnet.

1,080,412. SIPHON RECORDER; S. G. Brown, London, Eng. App. filed Feb. 6, 1912. Employs short siphon tube and controls its movements in a way to reduce its inertia.

1,080,414. ELECTRIC CLOCK; F. Brunko, Zurich, Switzerland. App. filed March 25, 1913. Contact is scraped clean by means of a vibratory device during the time that the second contact member does not bear against the contact.

1,080,475. INDUCTION MOTOR; W. H. Powell, Milwaukee, Wis. App. filed March 4, 1911. Forces the conducting bars and short-circuiting rings of the squirrel-cage winding in intimate contact with each other by means exterior to the bars.

1,080,480. ELECTRIC FIRE ALARMS; F. Ricords and M. Lewry, New York, N. Y. App. filed Dec. 27, 1912. Combined fire-alarm box and push-button switches for sending in an alarm.

1,080,483. PRIMARY BATTERY; C. B. Schoenmehl, Waterbury, Conn. App. filed Dec. 9, 1910. Two compressed oxide of copper negative electrodes so arranged with respect to the positive electrodes as to insure four working faces.

1,080,484. GALVANIC BATTERY; C. B. Schoenmehl, Waterbury, Conn. App. filed April 23, 1912. Copper oxide plate and the coacting zinc electrodes are properly supported on a frame suspended from the cover of the jar by a single supporting rod.

1,080,493. THERMO REGULATOR; W. J. Smith, Urbana, Ill. App. filed June 30, 1911. Combination of thermostat and relay control to maintain constant temperature.

1,080,496. FUSE FOR ELECTRIC CUT-OUTS; L. E. Steward, Muncie, Ind. App. filed Dec. 10, 1912. Fuse strip detachably secured to inwardly extending terminals carried by the end caps of the cartridge.